

Guidelines for Counties and Municipalities to Protect Ecological Features of State Resource Areas

March 2008



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**The Delaware Department of Natural Resources and
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EXECUTIVE SUMMARY

State Resource Areas (SRAs) are Delaware's most environmentally valuable undeveloped lands including parks, natural areas, conservation areas, certain wetlands, forests, farm lands, cultural and geological resource areas. SRAs are important as they provide vital economic benefits, provide wildlife and plant habitat, protect water and air quality and generally enhance the quality of life of the people of Delaware. SRAs are defined and their importance is explained in Chapter 2.

Protection of SRAs is the shared responsibility of the State, counties and municipalities as indicated below:

- The Department of Natural Resources and Environmental Control (DNREC) has mapped the State Resource Areas and provided the maps to the three counties and made them available to the towns and the public.
- Each county and municipality is to include the State Resources Areas in their comprehensive plans.
- County and municipal plans are to be certified by the Governor.
- Eighteen months after the Governor certifies a county plan overlay zoning ordinances, environmental performance standards, design criteria and mitigation measures must be in place to protect the SRAs. Though not required to do so, towns are encouraged to take these or similar steps to protect SRAs within their jurisdiction.

Through this report DNREC is providing a set of Ecological Guidelines, listed in Section 1.1 of the Introduction, to protect the ecological features of SRAs. Though prepared for use by the counties and municipalities in meeting their responsibilities, other people involved in land use planning and environmental protection may also find them useful. Another purpose of this report is to alert the general public about the significance of SRAs so they can support their local government's efforts to protect these areas. Additionally, the guidelines can be used by property owners as they care for their land and its resources. An important purpose of the guidelines is to demonstrate that protection of SRAs does not mean prohibition of development. These guidelines contain specific recommendations for achieving both goals – allowing development to occur while protecting the ecological values of SRA lands.

The guidelines are DNREC's core policy for protection and management of SRAs. The Ecological Guidelines are based on scientific research, ecological processes and how land use and development affects those processes. The research on which the guidelines are based, potential negative impacts to SRAs and techniques to avoid those impacts are summarized in Chapter 3.

Throughout Delaware there are 285,890 acres of SRAs representing 22% of Delaware's total land area of 1,285,795 acres. Through a combination of ownership/easement and county regulations in the three counties, 224,373 acres (79%) of the SRAs, are already protected. Thus, only 60,717 acres of SRAs, less than 5% of Delaware's total land area,

are unprotected at this time. Table 5-1 provides those data for the State and each county and the county maps presented in Figures 5-1 through 5-3 show the geographic distribution of the SRAs.

Chapter 4 outlines the SRAs elements that should be included in comprehensive plans including:

- The SRAs map as part of the plan's conservation element.
- Discussion of SRAs in relation to the conservation element.
- Strategies for land use decision-making that address the Ecological Guidelines including regulations, policies, and programs.
- Outline for a development review process for projects proposed within SRAs.
- Partnerships needed for protection of SRAs.
- Commitment to implement the SRAs protection strategies.
- Timeline for when the strategies will be implemented.

Existing programs and strategies that are already being used in Delaware to protect SRAs are summarized in Chapter 4 as are examples of land protection and design measures in use in other jurisdictions throughout the United States. Delaware's counties and municipalities can consider these techniques as they decide how to meet their SRAs protection responsibilities.

Case studies are presented in Chapter 5 that illustrate ways to protect SRAs. Chapter 6 presents an example of a process that counties and municipalities could use or adapt for reviewing development proposals that occur on lands containing SRAs. The report also includes a list of publications that provide valuable information for use in the protection and management of SRAs.

The guidelines and related materials put forth in this document focus on protection of the ecological features of Delaware's most important open space lands. The Delaware Land Protection and Quality of Life Acts extend beyond natural resources to address cultural and other important features of Delaware. Therefore, additional guidelines and recommendations may be made available in the future.

1.0 INTRODUCTION - PURPOSE OF DOCUMENT

Protection of natural resources and open space in Delaware is a shared responsibility between the State, counties, and municipalities, as prescribed in the 1990 Delaware Land Protection Act (7 Del. C. §75) and the 1988 Delaware Quality of Life Act (9 Del. C. § 2651, § 4951, and § 6951). Pursuant to these Acts, it is the State's responsibility to provide the counties and municipalities guidance on how to meet the requirements of the Acts. This document is one of several steps by the State to provide this guidance.

The Delaware Land Protection Act authorizes the mapping of State Resource Areas (SRAs), which are open space lands that are valued for their natural, cultural, and geological significance¹, so that the maps can be used to guide county and municipal comprehensive land use planning. Specifically, the Act requires that Delaware counties and municipalities that contain SRAs include SRA maps in their comprehensive land use plans. Once a comprehensive plan is certified by the state, county governments have additional responsibilities. Within 18 months of plan certification, counties are expected to develop and implement overlay zoning ordinances, environmental performance standards, design criteria and/or mitigation requirements to protect the important features of SRAs². Although not required by law, municipalities are being encouraged to adopt similar protection measures.

The Delaware Quality of Life Act requires that counties implement comprehensive planning programs that achieve the most appropriate use of land, water, and resources consistent with the public interest and deal effectively with future problems that may result from the use and development of land within their jurisdictions. Through the comprehensive planning process, counties are expected to conserve, develop, utilize, and protect natural resources within their jurisdictions. Specifically, the Quality of Life Act requires that county comprehensive plans include maps that depict natural areas and include policy recommendations for the conservation, use, and protection of natural resources. While the Quality of Life Act does not reference SRAs specifically (SRAs were not mapped until 1990), inclusion of SRA maps and associated policy recommendations for protection of SRAs, as required under the Land Protection Act, contributes to the Quality of Life Act requirements relative to natural resources.

The State is providing this document to help guide counties and municipalities in fulfilling their requirements for the conservation of natural resources and SRA protection, as stipulated in the Acts. Specifically this document provides recommendations for:

¹ The full legal definition of SRAs can be found in the Delaware Land Protection Act. See Section 2 of this document for further details on the definition and importance of SRAs.

² Letter from Delaware Department of Natural Resources and Environmental Control and the Office of State Planning Coordination to the counties dated January 19, 2007

- incorporating SRA maps and SRA protection strategies in comprehensive plans; and
- preparing overlay ordinances, performance standards, and design criteria to protect the ecological features of SRAs.

The State will use these recommendations in evaluating the extent to which county and municipal plans and implementation programs designed to protect SRAs are meeting the policies and intent of the Land Protection Act and the Quality of Life Act.

Because the Land Protection Act and the Quality of Life Act also address issues unrelated to natural resources, such as cultural and geological resources, public health, public safety, law enforcement, transportation, schools, etc., the State may choose to amend this document in the future to expand the recommendations to align more fully with the broad purposes and interests reflected in the Acts.

1.1 Ecological Guidelines

The recommendations in this document are grounded in the following eight Ecological Guidelines that the Department of Natural Resources and Environmental Control (DNREC) has embraced as its core policy for natural resource protection:

- 1) Maintain large areas of contiguous habitat and avoid fragmenting these areas;
- 2) Maintain meaningful wildlife corridors and potential non-consumptive bicycle and pedestrian connections between habitat areas and adjacent land uses;
- 3) Protect rare landscape elements, sensitive areas, and associated species;
- 4) Allow natural patterns of disturbance to continue to maintain diversity and resilience of habitat types;
- 5) Minimize direct and indirect human disturbances and the introduction and spread of nonnative species and favor native plants and animals;
- 6) Minimize human introduction of nutrients, chemicals, and pollutants;
- 7) Avoid land uses that deplete natural resources over a broad area and allocating such land uses to areas of minimal natural resource impacts; and
- 8) Compensate for adverse effects of development on natural processes.

The Ecological Society of America first developed these Ecological Guidelines to facilitate incorporation of ecological considerations into land use decision making (Dale et al, 2000). Subsequently, the Environmental Law Institute retooled these guidelines to apply directly to local land use planning decisions (McElfish, 2004). The eight guidelines above allow local decision making to be examined in two overarching dimensions:

- The impacts of local decisions in a regional context, and
- The impacts of local decisions over time considering foreseeable future changes in the landscape.

Section 3 of this document provides a detailed discussion of the Ecological Guidelines.

2.0 WHAT ARE SRAs AND WHY ARE THEY IMPORTANT

2.1 Definition of SRAs

SRAs are defined in the Delaware Land Protection Act as “those open space lands duly identified by the (Delaware Open Space) Council and adopted by the Department (DNREC) for protection”. SRAs are essentially the state’s most valuable undeveloped lands. In the current (2006) version of the SRA maps, approximately 285,000 acres of land, or 22 percent of Delaware’s total land area, are designated as SRAs³. All three counties and twenty of the state’s municipalities contain SRAs. The SRAs contain several types of lands, including:

Conservation lands: federal, state, county, city, and private conservation organization lands, public and private conservation easements, and agricultural preservation easements.

Delaware’s Green Infrastructure (GI) lands: Lands included in Delaware’s Green Infrastructure Program, initiated in 2001 under Executive Order #61. The GI lands are the State’s strategically planned and managed network of forests, parks, greenways and open spaces.

Wetlands: tidal wetlands and nontidal wetlands.

Forests: blocks of natural forests (i.e., not tree farms) that meet the minimum area thresholds of 250 acres or larger in Kent and Sussex Counties or 150 acres or larger in New Castle County.

Delaware’s Key Wildlife Habitats (KWH): Natural resource lands important for the conservation of the state’s wildlife diversity.

Cultural resources: significant cultural, historical, or archaeological sites as determined by state plans and policies adopted by the Division of Historical and Cultural Affairs.

Silvicultural or agricultural lands: silvicultural lands (i.e., managed forests) or agricultural lands (i.e., lands used for production of food or other products useful to humans) that are either surrounded or nearly surrounded by natural lands.

³ A description of the methodology used in developing the mapping is available from DNREC and can be found at <http://www.dnrec.delaware.gov/OpenSpaces/SRA.htm>

2.2 Importance of SRAs

SRAs encompass the most important of the state's open space lands⁴ and they provide vital economic, social, environmental benefits to all Delawareans. These benefits can be expressed in terms of ecosystem services, or the processes by which the natural environment produces resources useful to people. The following examples illustrate some of the ecosystem services that SRAs provide.

Supporting the economy and increasing and protecting property value: SRAs contribute hundreds of millions of dollars to Delaware's economy each year through hunting, fishing, wildlife watching, and tourism. Riparian buffers and wetlands also minimize floods and protect shorelines from erosion, which can threaten property in coastal areas and along streams.

Enhancing livability and quality of life: SRAs enhance livability and quality of life by providing scenic beauty and natural resource-based outdoor recreation. The State's counties recognize the importance of open space to overall livability and quality of life, and cite the preservation of these characteristics as goals of their comprehensive plans. The goals of New Castle County's draft comprehensive plan cite open space as an important component of the county's "quality of life" (New Castle County, 2006). The Open Space, Greenways, and Recreation section of Kent County's comprehensive plan states that open space enhances the quality of life for current and future Kent County citizens (Kent County, 2002). The Community Design Element of Sussex County's comprehensive plan considers open space vital to the aesthetic quality of the county (Sussex County, 2003).

Provision of wildlife and plant habitat: Delaware's SRAs are the backbone of the state's network of natural habitats and they support the majority of native plants and animals in the state. Without the protection of SRAs, much of Delaware's wildlife habitat is vulnerable to loss. For example, over 40 percent of Delaware's native wildlife species are forest-dependent and SRAs contain all of Delaware's remaining large contiguous blocks of forest that are critical to the maintenance of these species.

According to Delaware's Wildlife Action Plan, nearly half of the wildlife species and habitats in the state are in need of conservation (DNREC, 2006). Most of these species and habitats occur within SRAs so preservation of these areas is critical to maintaining viable rare species populations and habitats in the state.

Maintenance of natural landscape processes: Natural habitats develop in response to a variety of biological and physical processes. Many habitats and ecosystems require periodic disturbance to persist over time. Delaware's riparian forest habitats illustrate the role of disturbance in maintaining natural habitats. Riparian forest habitats occur only in

⁴ The Delaware Code defines open space as lands characterized by natural scenic beauty or lands whose condition, if retained, would maintain important recreational, cultural, and natural resources and enhance the present or potential value of abutting or surrounding urban development.

floodplains, where seasonal floods maintain supplies of nutrient-rich sediments, and support plants adapted to seasonally wet conditions. Without periodic floods, riparian forests would lose plant species that are adapted to seasonal wet conditions and depend on the rich soils that are characteristic of this habitat type. Protection of SRAs allows natural disturbance patterns, such as flooding, to persist, thereby maintaining important natural ecosystems and species such as riparian forests.

Protection of water and air quality: Most of the streams and lakes in Delaware are listed as having impaired water quality by the Environmental Protection Agency (DNREC, 2007). The most common cause of impairment is an excess of nitrogen and phosphorous, which comes from many sources including fertilizers, animal wastes, and septic systems. Riparian forests and wetlands are highly effective at reducing nitrogen and phosphorous pollution, which are transmitted to streams and lakes primarily through stormwater runoff. Forests assimilate significant quantities of groundwater and stormwater, thereby increasing the potential for absorption and retention of nutrients or other chemicals. The amount of pollutants absorbed by forests varies widely, but experimental data suggests that forests may absorb more than twice the amount of polluted runoff as non-forested habitats (Rockefeller et al., 2004). A recent study conducted by the United States Department of Agriculture demonstrated that riparian forests and wetlands retained or removed at least 60 percent of the nitrogen and 65 percent of the phosphorus that entered from adjacent farmlands (Lowrance, 2003).

Forests improve air quality by generating oxygen and removing harmful pollutants from the air. Trees sequester (absorb and store) many pollutants from the atmosphere, including nitrogen dioxide, sulfur dioxide, ozone, particulate matter, and carbon dioxide, and thus reduce the rate of increase of pollutants in the atmosphere. For example, in Washington, DC, trees remove roughly 900,000 pounds of pollutants from the air each year (Novak and Dwyer, 2000). In 1999, Delaware's forests were estimated to have stored nearly 20 million tons of carbon (DFS, 2006).

The ability of SRAs to continue to provide these and other vital ecosystem services is directly related to our ability and commitment to protect these areas. Using the eight Ecological Guidelines that DNREC has embraced, and implementing them in local land use planning and decision making, as recommended in this document, will ensure that SRAs maintain the ability to provide ecosystem services, such as those described above.

3.0 ECOLOGICAL GUIDELINES FOR LAND USE PLANNING

The eight Ecological Guidelines presented in Section 1 are based on an extensive body of scientific research on ecological processes and how land use and development affects these processes. The following section provides a summary of the research as well as some real world examples for how these guidelines are being successfully incorporated into land use planning efforts in Delaware and other states.

Ecological Guideline 1 - Maintain large areas of contiguous habitat and avoid fragmenting these areas

Maintaining large areas of natural habitats that are not fragmented is very important for supporting wildlife populations and ecosystem processes. Large blocks of contiguous habitat often support more wildlife species than smaller or fragmented areas because the habitats are usually more complex (e.g., more vegetation species, soil types, hydrologic regimes, etc.) (Dale, et al, 2000). The relationship between habitat size and wildlife species diversity has been demonstrated for birds (Jones et al., 2001), mammals (Yates et al., 1997), and amphibians (Vallen, 2002).

Species that require large areas of contiguous habitat for survival and reproduction are known as “area dependent” or “umbrella” species, and large, contiguous habitats are critical to protecting these species within a developing landscape (Dale, et al., 2000). Some examples of area-dependent wildlife species in Delaware include brown creeper and black and white warbler (Heckscher, 2000; TNC, 1998).

Minimizing habitat fragmentation is an important aspect of maintaining large habitat areas and supporting wildlife populations. Habitat fragmentation causes an increase in the ratio of edge to interior habitat, which alters the structure and composition of biological communities within the habitat (Robinson, et al. 1995). These “edge effects” are particularly well documented in forests, and include soil desiccation from increased light and wind penetration, increased incidence of invasive vegetation species, increased brood parasitism in breeding birds, and increased predation (TUCGIS, 2006).

Minimizing habitat fragmentation is also critical to maintaining ecosystem processes. For example, the flow of organic material from terrestrial to aquatic habitats is an ecosystem process that requires unfragmented habitats to function optimally. Aquatic food webs in headwater streams are based primarily on detritus that falls into the stream from adjacent terrestrial



habitats. Fragmentation of terrestrial and aquatic habitats (e.g., by a road or other development) alters the organic input to the stream, potentially causing collapse of the aquatic food web.

Actions that preserve large areas of contiguous habitat and avoid habitat fragmentation within SRAs will help support Delaware's native wildlife and ecosystem processes. Some examples of how counties and municipalities can implement this Ecological Guideline include (see Table 5.3 for more detail):

- Ensure that development plans minimize the development footprint within SRAs and avoid fragmentation of SRAs - establish development review process that evaluates these measures.
- Locate natural open space within SRA, wherever possible.
- Locate natural open space such that it is contiguous or near offsite natural open space – establish development review process that considers the location of offsite natural open space relative to onsite open space.
- Aggregate open space for multiple developments to create large habitat blocks and/or corridors rather than numerous small, unconnected open spaces.
- Implement ordinances that specify priorities for the location of rights of way for utilities and roads to minimize fragmentation of SRAs and other natural habitats.

Ecological Guideline 2 - Maintain meaningful wildlife corridors and potential non-consumptive bicycle and pedestrian connections between habitat areas and adjacent land uses



Wildlife corridors preserve the continuity of undeveloped lands within developing areas. Corridors preserve connections between different habitats and/or large habitat blocks and so limit the potential for species isolation (Aber at al., 2000; Lindenmayer, 1994). Recent research suggests that corridors are also very important at conserving plant diversity in developing landscapes (Damschen et al., 2006). Corridors are also an excellent means of providing people with connections between large open spaces. In many instances, corridors can support non-consumptive (i.e., non-resource depleting) human activities such as hiking, biking, and wildlife watching, which can promote appreciation of open spaces and support for protecting them.

Ecological Guideline 3 - Protect rare landscape elements, sensitive areas, and associated species

The amount of land needed to protect rare habitats and species varies according to the habitat and species and the degree of protection sought. However, most large-scale habitat and ecoregional conservation planning efforts in the U.S. recognize the need to protect larger tracts of open space and rare habitats, and typically call for 15- 30 percent of a landscape to be protected (Stein et al. 2000; Shaffer 2002; Chaplin et al., 2003).

Dobson et al. (1997) estimated that 14 percent of the U.S. land area would be required to maintain viable populations of all currently listed federally listed threatened or endangered species.



According to Delaware's Wildlife Action Plan, over 1,000 species of wildlife and 125 different types of habitat occur in the state and more than 450 of those species and 50 of those habitats are in need of conservation (DNREC, 2006). SRAs currently encompass approximately 22 percent of Delaware's land area and most of Delaware's rare habitats and species. Therefore, protection of SRAs through implementation of the Ecological Guidelines and recommendations provided in Section 4 of this document is critical for conserving Delaware's rare habitats and species (DNREC, 2006).

Ecological Guideline 4 - Allow natural patterns of disturbance to continue to maintain diversity and resilience of habitat types

Disturbance is a vital component of naturally functioning ecosystems. The magnitude, spatial distribution, and frequency of natural disturbance are important factors in determining the composition and structures of vegetative communities (Pickett and White, 1985). Vegetative communities are a driving factor in biodiversity (Huston, 1994). Thus, forests that maintain a natural disturbance regime generally conserve biodiversity (Attiwill, 1994; Patch, 1998).

Resilience is the ecological response to natural disturbance. A resilient ecosystem depends on



natural regenerative processes and a balanced distribution of species, populations, and age classes to recover from disturbances (LFC, 2006). Ecosystems in which the natural disturbance regime is interrupted, quickly adapt to an artificially stabilized environment and often lose the qualities that made them resilient in the past. When disturbance is restored to the system, the results are often catastrophic. Devastating fires in fire-suppressed forests are perhaps the most thoroughly documented example of the effects of interrupting the natural disturbance regime of an area. Protection of SRAs allows for the maintenance of natural disturbance regimes, thereby maintaining natural ecological resilience and reducing the potential for catastrophic ecological disturbances.

Ecological Guideline 5 – Minimize direct and indirect human disturbances and the introduction and spread of nonnative species and favor native plants and animals

Non-native, invasive plant species pose a threat to native plant communities and wildlife habitat, because they have few natural predators and can be aggressive competitors, allowing them to spread quickly and often outcompete native plants on which native wildlife depend (Peterson, 2003; Peterson and Viegas, 2001). Common reed (*Phragmites australis*) is an example of an invasive plant species that has become ubiquitous throughout Delaware’s freshwater wetlands.

Unnatural (i.e., human) disturbance tends to promote colonization of an area by non-native, invasive species (Colautti et al., 2006). The correlation between invasive species and human disturbance is so strong that in some forests the number and richness of invasive species seeds in forest soil can play an important role in quantifying human disturbance (Lin et al., 2006). Proximity to a source of invasive species also plays a role



in susceptibility to invasion (Briggs, 2007; Arndt, 2006).

Undisturbed communities that are composed primarily of native species and that are distant from non-native, invasive species infestations tend to resist colonization by invasive species (Mandryk and Wein, 2006). Therefore, actions that reduce

human disturbance within or in the immediate vicinity of SRAs tend to reduce SRAs’ susceptibility to invasion by preserving ecological integrity and isolating them from potential sources of invasive species.

Ecological Guideline 6 – Minimize human introduction of nutrients, chemicals, and pollutants

Releases of nutrients, chemical contaminants, and pollutants into the environment are potentially harmful to the ecology of sensitive natural areas. Nutrient concentration affects water quality, aquatic food webs, and ultimately the overall ecology of freshwater and marine ecosystems (Smith et al., 1999). For example, excess nutrients in an aquatic system can cause an algal bloom, which is an increased growth of algae or other green plants. Some algal blooms are harmful to the environment, producing a range of negative effects, such as depleting oxygen in the water and thus threatening aquatic life or producing toxins that can kill fish or shellfish and cause human illness. Harmful algal blooms have occurred throughout Delaware, most notably in Delaware's Inland Bays.

Chemical pollutants also can change the physiology, behavior, or life-history of exposed organisms (EPA, 2006). Most pollutants can be categorized as nutrients, chemicals, or both, but in recent years the general definition of water pollution has been expanded to include excess sediment (CBP, 2001), which can also exert ecological effects primarily through changes in aquatic and riparian habitat.

Nutrients, contaminants, and sediments are released in stormwater or wastewater, and some chemical pollutants can also be transported via atmospheric processes. Sediment pollution can be transported by runoff, wind, or purely geological processes. SRAs contain pollution-sensitive ecological receptors such as wetlands, streams, and the species they support, but they also include natural upland buffers that assimilate and sequester potentially harmful nutrients and pollutants before they reach sensitive waterways. The minimum effective width for buffers varies according to several factors such as surrounding land use, topography, watershed hydrology, vegetation composition and structure, soil type, etc (Westchester WAC, undated). Actions that preserve buffers both within and adjacent to SRAs help preserve Delaware's most pollution sensitive wildlife and habitats.



In order to protect water quality in its freshwater and estuarine waterbodies, Delaware has developed Total Maximum Daily Loads (TMDLs), which are the maximum levels of pollution allowed in a watershed based on scientifically-determined estimates of a watershed's capacity to withstand the effects of specific pollutants.

Delaware also has developed Pollution Control Strategies (PCS) to ensure compliance with the TMDLs.

The SRA, TMDL, and PCS programs conserve natural resources through complementary mechanisms. The SRA network assists the state in meeting the goals of the TMDL and PCS programs of reducing water pollution by naturally buffering streams, rivers, and wetlands. By establishing limits for specific pollutants based on local water quality conditions, TMDLs serve as benchmark against which the effectiveness of the PCS and other water quality-related measures, including the SRAs, can be measured.

Ecological Guideline 7 – Avoid land uses that deplete natural resources over a broad area and allocating such land uses to areas of minimal natural resource impacts

Conservation-focused design principles such as compact development, setbacks from sensitive resources, and open space protection requirements minimize losses of natural resources by minimizing the footprint of development. Ample opportunities and methodologies exist to minimize the footprint of developed areas and integrate natural features into developed landscapes (McElfish, 2004; LIDC, 2007). The ecological



value of undeveloped land within or near developed landscapes often suffers somewhat from their proximity to intense human activity due to edge effects (See Conservation Strategy 1), but these lands remain ecologically valuable. Proximity to development limits habitat utilization by the most sensitive species, but other species are able to coexist with humans in close proximity provided that adjacent wild habitats are left undisturbed (Riley, 2006). For example, Rodewald and Matthews (2005) found that percent urbanization within one kilometer of forests was unrelated to abundance of breeding birds within those forests.

Ecological Guideline 8 – Compensate for adverse effects of development on natural processes



Mitigation for unavoidable impacts to natural resources can be an effective way to compensate for the adverse impacts of development. The success of compensatory mitigation projects is determined by a complex set of

factors and successful replacement of impacted ecological functions can be difficult (Pirnat, 2000; Robb, 2002; Teels et al., 2004); however, it is possible given adequate time, resources, and planning (Balcombe et al, 2005). Actions that focus on avoidance and minimization of impacts, but provide for mitigation of unavoidable impacts when appropriate, provide an effective and practicable approach to protecting the ecological features of SRAs.

4.0 CASE STUDIES

The following three case studies are hypothetical development projects in the State of Delaware. The case studies do not represent actual projects nor do they take into account land ownership (they do not necessarily represent one landowner). These case studies were conducted to compare conventional development (i.e., as per existing regulations) with “resource protection” development that is consistent with the eight Ecological Guidelines and limits impacts on SRAs.

The case studies were conducted on September 6 and 14, 2007 using a workshop or “charrette” format facilitated by ERM and Gaadt Perspectives and attended by DNREC and Office of State Planning Coordination staff. The workshops involved the following steps:

1. Prior to convening the workshop, DNREC Geographic Information Systems (GIS) staff identified several sites for potential use as case studies. Three of these sites were ultimately chosen, based on their size (over 250 acres) and presence of SRAs and natural resources (e.g., wetlands, streams, floodplains, rare species, groundwater recharge areas). GIS maps were created for each site depicting each site’s resources, using aerial photography as a background.
2. The workshop convened and the attendees reviewed the Ecological Guidelines and the fundamentals of resource protection design (often referred to as Conservation Design), discussed the attributes of the three case study sites, and reviewed the maps for each site.
3. Next, the group worked on each site individually, starting with the conventional development option. The conventional development options were based on existing county land use ordinances, with the intent of maximum residential/single family build out. Lots were hand drawn on trace paper for later conversion to GIS.
4. After each conventional development option was completed, the group developed the “resource protection” option, which incorporated the existing county ordinances **and** protection for SRAs and other natural resources on the site. A developable area was defined after setting aside the SRA and other significant natural resources that lie outside the SRA (wetlands, rare species or habitats, etc) and the development was planned within that area. This option used the site’s SRA and other natural features as assets for the development, minimizing the need for stormwater management facilities, reducing the amount of necessary bulk grading, reducing requirements for paving and utilities, and significantly lowering overall engineering costs.
5. The resource protection option was developed to mirror the conventional development option in terms of general type and number of units so there was no attempt to include mixed-use housing, which could have significantly increased the number of units.
6. Furthermore, it should not be concluded that this exercise in any way implies that the designs prepared are the best layout or configuration for site development;

these designs should be considered one way in which to accomplish resource protection objectives.

The following sections present the results of the case studies.

Case Study 1



Table 4-1. Case Study 1 Information Summary

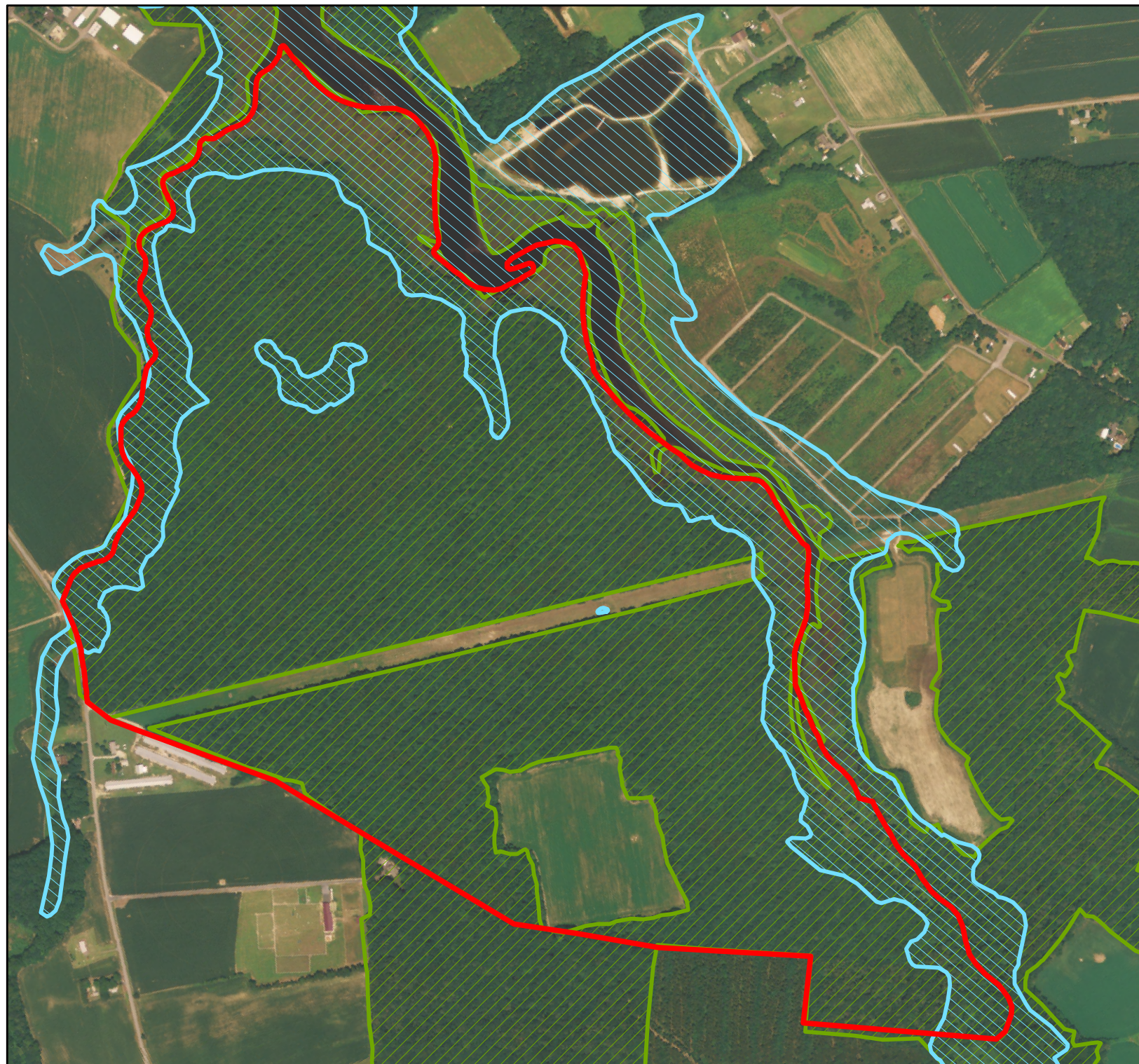
Total site area	General site description	Development proposal	County ordinances applied
365 acres	Over 90% of the site lies within an SRA. The majority of the site is forested, with a utility line easement bisecting the center and a small agricultural field in the southern portion of the site. The north, east, and west edges of the site contain tidal wetlands. Two groundwater recharge areas lie near the central portion of the site. One small, isolated non-tidal wetland lies in the northern portion of the site (Figure 4-1).	Single family subdivision. Spray irrigation was chosen as the most environmentally sensitive method of treatment on this particular site, although it is more land-consumptive.	<ul style="list-style-type: none"> • Sussex. • Development prohibited in tidal wetlands. • Allowable density based on gross tract acreage - two units per acre with individual well and septic and greater density with public sewer. • 30 foot setback requirement where the property boundary abuts active agriculture.

State Resource Areas Options for Development of Property Containing SRAs

FIGURE 4-1
Case Study 1: Existing Conditions

Legend

-  Proposed Development (365 Acres)
-  State Resource Areas
-  Wetlands and 100 year Floodplains



Map produced by the Department of
Natural Resources and Environmental
Control (DNREC). The information
depicted is provided as a graphical
representation only. DNREC provides
no guarantee, expressed or implied, as
to the accuracy of any boundary lines.



Case Study 1 Conventional Option – The conventional option resulted in 545 units (note that it is impossible to achieve full allowable density given ordinance constraints on single family development), with an average lot size of 15,000 square feet. This option avoided impacts to tidal wetlands and floodplains but impacted 3 acres of non-tidal wetlands, developed the majority of the SRA land, and offered no internal community open space (Figure 4-2).

Case Study 1 Resource Protection Option – The resource protection option resulted in 545 units, with an average lot size of 8,700 square feet. The option avoided impacts to all tidal and nontidal wetlands, floodplains, and recharge areas and retained 60 percent of the site as open space. Many homes front or back to open space and all wells, septic, and stormwater management areas were located in open space (Figure 4-3). This option allowed for the same number of units as the conventional option while protecting all of the site's SRA lands and natural resources and providing an amenity for homebuyers (community open space including trail system).

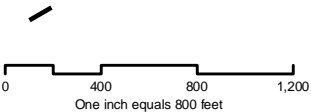
State Resource Areas
Options for Development of
Property Containing SRAs

FIGURE 4-2
Case Study 1:
Conventional Option

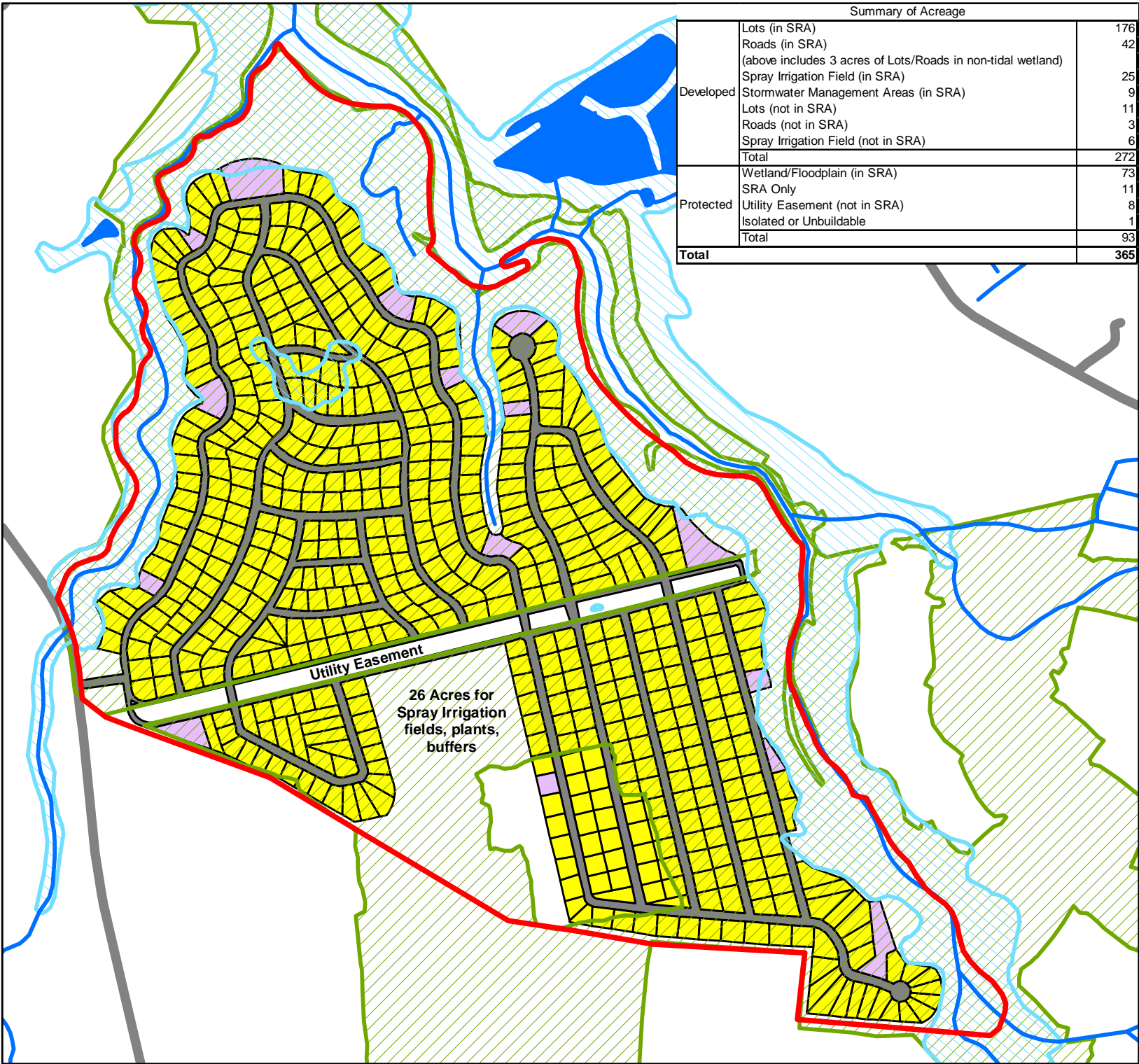
- 545 units
- Average lot size: 15,000 square feet
- Range: 10,000 - 26,000 SF
- Tidal wetland and floodplain avoided
- No SRA protection
- No internal open space

Legend

- Proposed Development (365 Acres)
- Lots
- Roads
- Stormwater Management
- State Resource Areas
- Wetlands and 100 year Floodplains
- Water



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State Resource Areas
Options for Development of
Property Containing SRAs

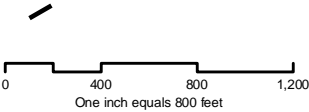
FIGURE 4-3

Case Study 1:
Resource Protection Option

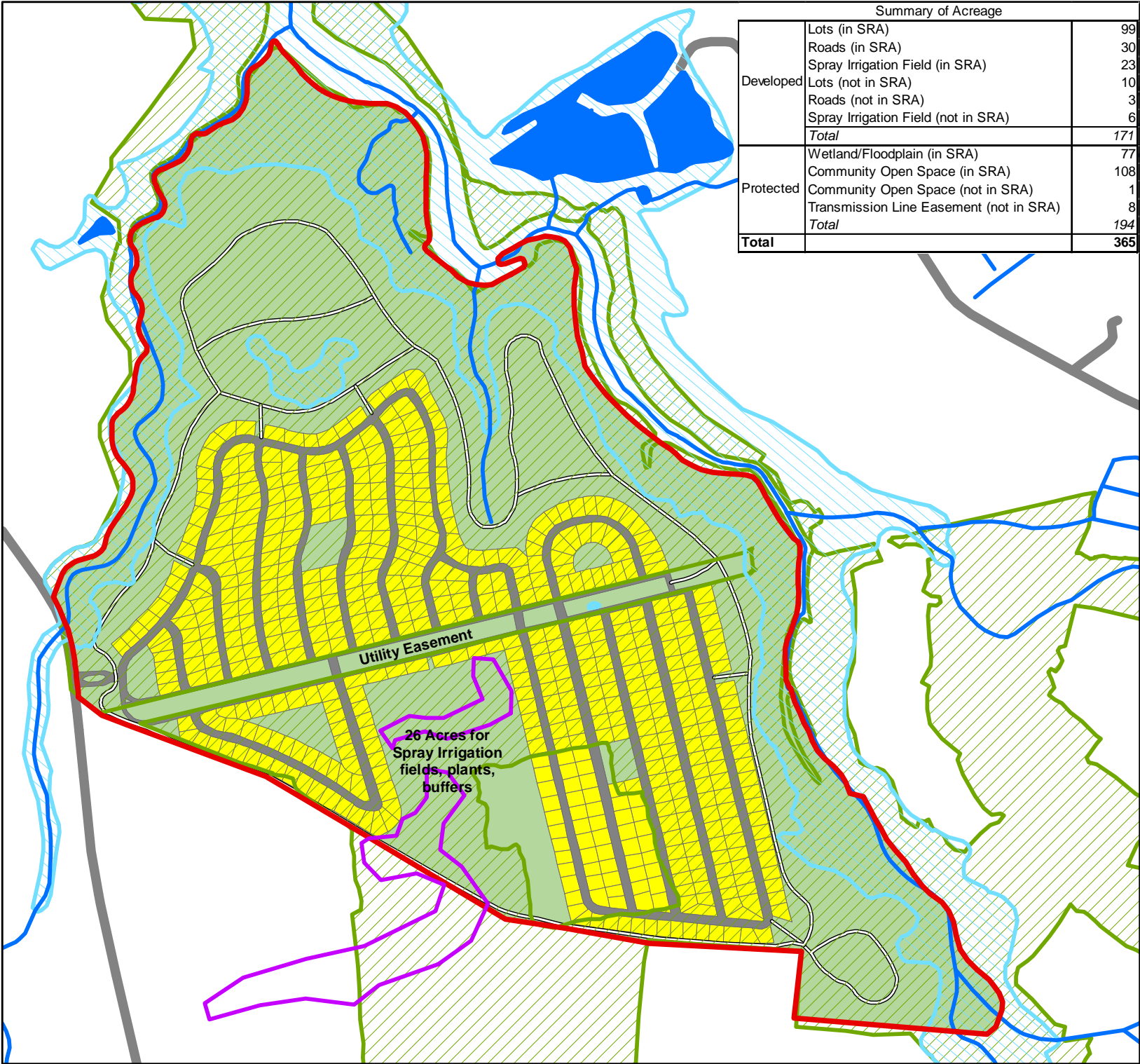
- 545 units
- Average lot size: 8,700 square feet
- 150-300' buffer around all water bodies and wetlands
- Wells, septic, and stormwater management areas in community open space
- 62% of site is open space
- Many homes front or back to open space
- All floodplains, wetlands, agricultural buffers, forest and recharge areas protected

Legend

- Proposed Development (365 Acres)
- Lots
- Community Open Space
- Roads
- Trails
- State Resource Areas
- Wetland-Floodplain
- Water
- Recharge Areas



Map produced by the Department of Natural Resources and Environmental Control (DNREC). The information depicted is provided as a graphical representation only. DNREC provides no guarantee, expressed or implied, as to the accuracy of any boundary lines.



Case Study 1 - Lessons Learned

- 1) A developer can achieve the same yield and protect all key features of the State Resource Area, while significantly reducing engineering, utility and site preparation costs. This type of environmentally sensitive development or Conservation Design can already occur under Sussex County's conditional-use, Residential Planned Community (RPC) zoning. In addition, Sussex County has a cluster option that can achieve similar results.
- 2) Such a development is an attractive alternative to more conventional developments and takes advantage of the natural features that are protected under this scenario.
- 3) Current county codes do not protect natural, scenic or historic resources (note: state regulations provide protection for tidal wetlands). Protection of site resources should be contemplated in the future. Doing so need not impact density if the County is willing to provide flexibility in site design (e.g., permitting smaller lots, mixed use, etc.). Furthermore, site resource protection standards will protect natural resources regardless of zoning classification or type of development. Unless applicants utilize the Residential Planned Community (RPC) or other cluster provisions, natural resources will likely not be protected.

In addition, the County should further consider whether using gross acreage to calculate density is appropriate (awarding density for undevelopable land).

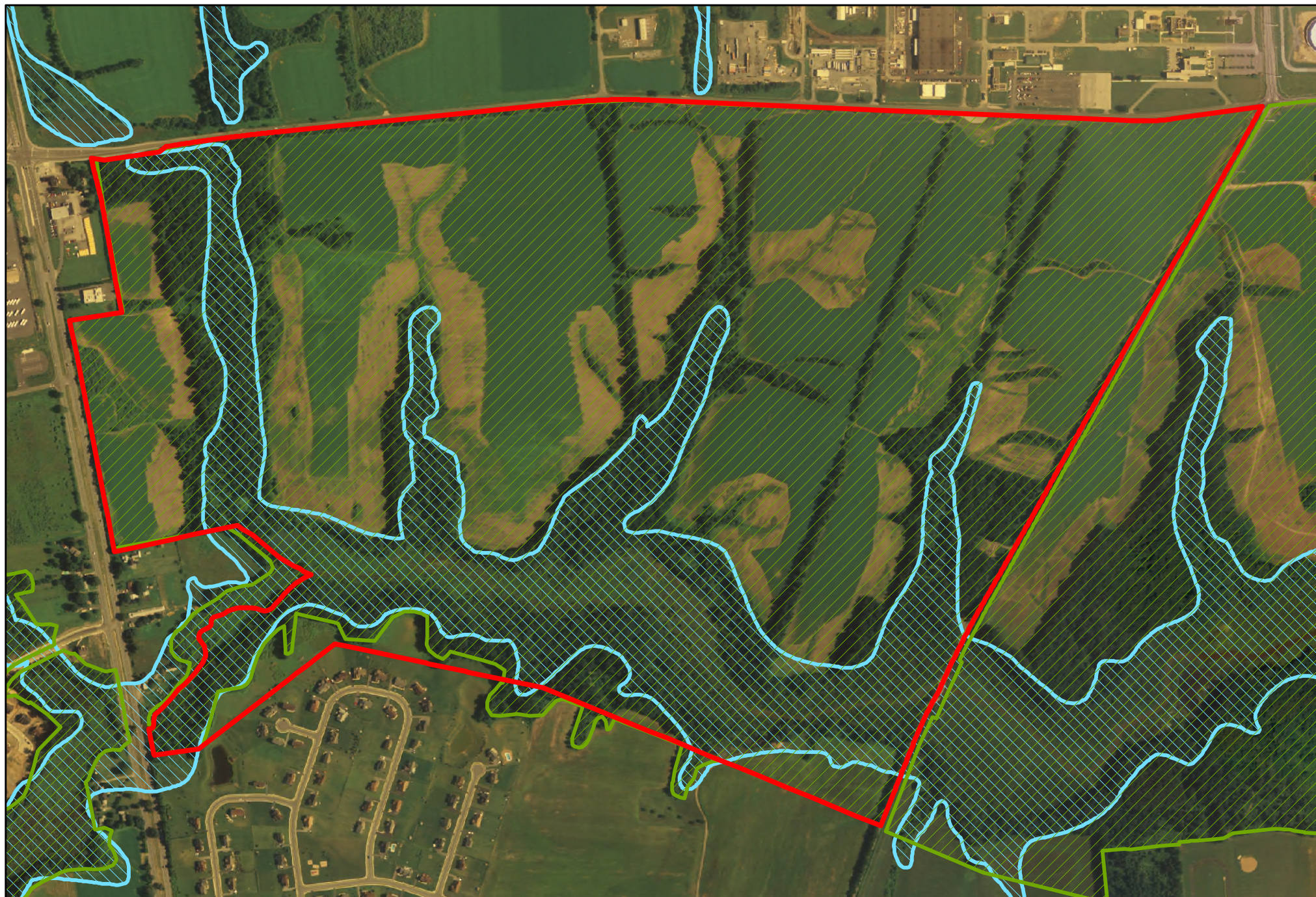
- 4) In order to provide incentives to protect resources, Sussex County could offer a Conservation Design "by-right" zoning option (possibly by tweaking the existing RPC and cluster regulations) and eliminate the burdensome need for special hearings. Other options to consider include: a fast tracking or streamlined review process, reduced fees for conservation design/resource protection plan proposals, permitted reductions in impervious cover requirements (sidewalks, curbing, road width, etc.), creation of a marketing tool for developers (such as that being discussed with the Center for Inland Bays to include promotional pieces, awards and plaques/signs) that attests to "green" development, and formation of a transfer of development rights (TDR) program that awards additional density credits for transfers from SRA lands.

Case Study 2

Table 4-2. Case Study 2 Information Summary

Total site area	General site description	Development proposal	County ordinances applied
540 acres	The entire site lies within an SRA. Roughly 40 percent of the site contains nontidal wetlands, with the remainder characterized as active agriculture (Figure 4-4)	<ul style="list-style-type: none">• Single family subdivision.• Public or community water and sewer.	<ul style="list-style-type: none">• New Castle• Development prohibited in nontidal wetlands, 100-year floodplains.• Minimum open space requirement 269 acres as per UDC.• Allowable density based on Single Family Conservation Design Option under the UDC.




Case Study 2 Single Family Conservation Design Option – For this case study, the conventional development option and the resource protection options are the same because the New Castle County Unified Development Code (UDC) currently protects the natural resources at the site. Accordingly, we developed the site according to the Single Family Conservation Design Option. This option resulted in 146 lots, with an average lot size of 20,000 square feet. Over 65% of the site is community open space or wetland, which accommodates all of the site’s stormwater management needs (Figure 4-5). Note that other Open Space options currently allowable under the UDC would permit smaller lots, mixed use, and higher density.



**State Resource Areas
Options for Development of
Property containing SRAs**

FIGURE 4-4
Case Study 2: Existing Conditions

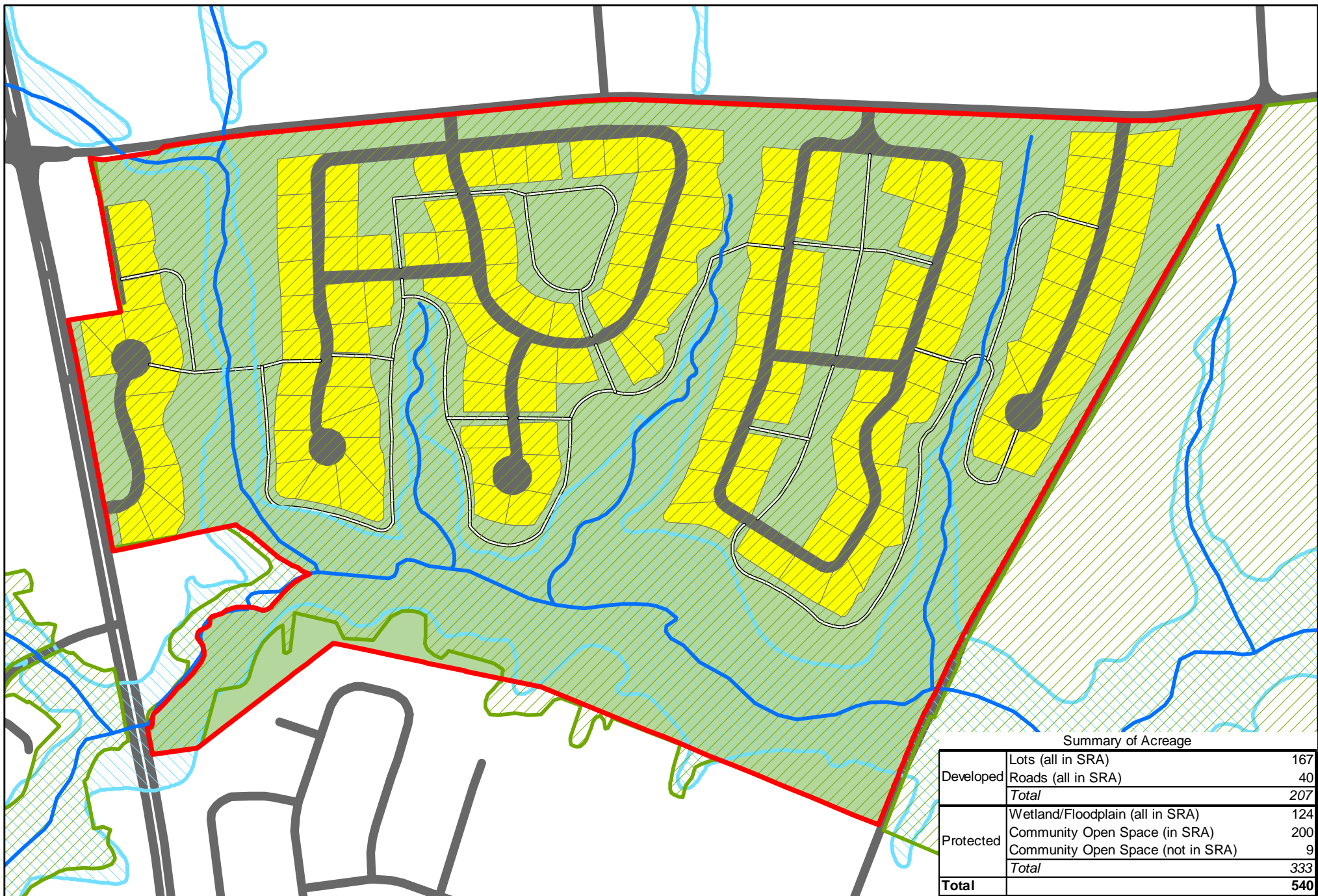
Legend

-  Proposed Development
-  State Resource Areas
-  Wetland-Floodplain

0 400 800 One inch equals 800 feet



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State Resource Areas Options for Development of Property containing SRAs

FIGURE 4-5

Case Study 2: Single-Family Conservation Design Option

Single-Family Conservation Design
 - 146 lots; average lot size: 20,000 SF
 - 40' yard width, 100' lot width
 - Minimum open space requirement: 269 acres
 - Well and septic on lots; stormwater management on community open space.
 - All resource land subtracted from density calculations

Note: Were applicant to use Open Space options that permit smaller lots and mixed use, more dwelling units would be permitted on this tract, given the provisions of the UDC.

Legend

- Proposed Development
- Lots
- Open Space
- Roads
- ~ Trails
- State Resource Areas
- Wetland-Floodplain
- ~ Streams

0 400 800 One inch equals 800 feet



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Case Study 2 – Lessons Learned

- 1) The New Castle County Code provides significant protection to natural, scenic and historic resources and offers multiple options for site development. Natural resource protection is achieved in three ways: (1) specific open space standards protect natural resources by insuring that portions of sites remain undisturbed, (2) resource protection levels (ratios) are part of a site capacity calculation that bases development intensity on actual site conditions, and (3) specific use, protection, and mitigation standards are provided for each natural resource. This combination strategy, coupled with the types of resources protected (Critical Natural Areas, Forests, Wetlands, Floodplains, Riparian Buffers, etc.), provides adequate protection to State Resource Areas.
- 2) The sketch plan prepared for NCC is considered one of the most land-intensive plans permitted under the Unified Development Code (although clearly not one of the highest density plans permitted under the code); nevertheless, this plan still protected and buffered significant natural resource lands.
- 3) The county should continue to use incentives to make its open space planning options even more attractive and achieve even greater resource protection; such options are currently the path of least resistance during the permitting process and should remain so. Options the county has considered in recent years include: a fast tracking or streamlined review process, reduced fees for open space plan proposals, and permitted reductions in impervious cover requirements (sidewalks, curbing, road width, etc.). It should be noted that New Castle County permits open space plans as “by-right” plan options and does not require special hearings for such plans.

Density bonuses are often discussed as a tool that can be used as an incentive to accomplish certain community goals; the converse of this also holds true, e.g., permitting full density only when community goals are achieved (such as natural resource protection and open space set-asides) and lesser density for land consumptive, resource depleting development.

- 4) It should be noted that the County’s resource protection standards are not specifically tied to the open space planning options under the UDC, although land preserved under the open space options can be made up of resource land otherwise protected. The County’s resource protection standards apply to all zoning categories or types of development.

Advantages of the County’s open space plan options include not only greater levels of protection, buffering and management of natural resources, but increased flexibility in site design, maintenance of natural site drainage characteristics, reductions in site grading and impervious cover, reduced stormwater management and other utility infrastructure costs, contiguous county-wide open space linkages, and a host of community benefits (access to active and passive recreation, lots backing or fronting to open space, etc.).




Case Study 3


Table 4-3. Case Study 3 Information Summary

Total site area	General site description	Development proposal	County ordinances applied
417 acres	Over 50 percent of the site lies within an SRA that contains forest, wetland, and floodplain. Several small isolated wetlands occur in the agricultural fields that make up the remainder of the site. The southwest corner of the site contains key wildlife habitats (Figure 4-6).	<ul style="list-style-type: none">• Single family subdivision.• Individual well and septic, community stormwater.	<ul style="list-style-type: none">• Kent• Development prohibited in nontidal wetlands, 100-year floodplains, steep slopes.• Forest conservation requirement – 30 percent forest clearing limit.• Low density requirement – 4 acre lots.

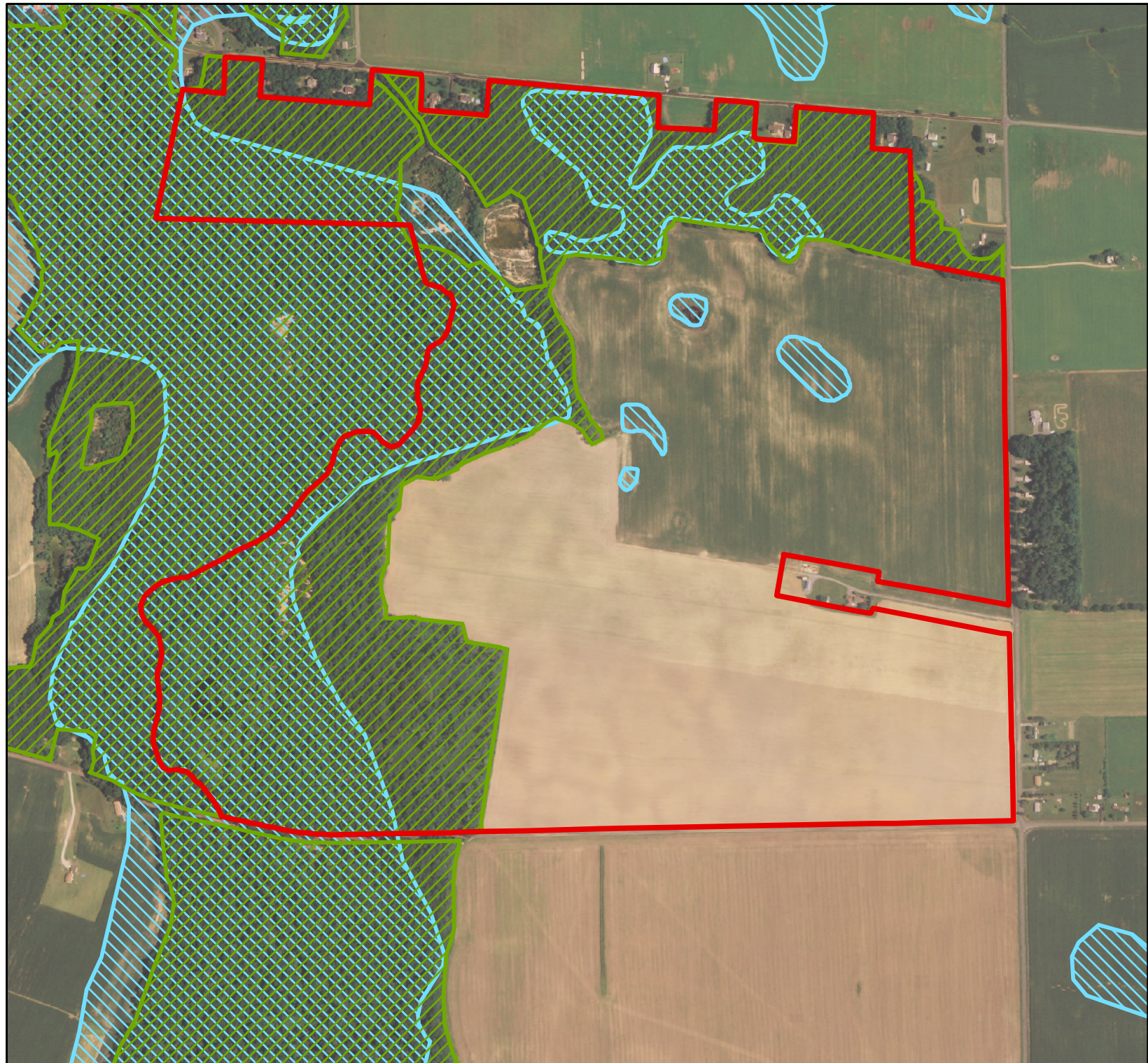
State Resource Areas
Options for Development of
Property Containing SRAs

FIGURE 4-6
Case Study 3: Existing Conditions
Legend

-  Proposed Development (417 Ac)
-  State Resource Areas
-  Wetlands and 100-year Floodplain


0 400 800 1,200
One inch equals 800 feet

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Case Study 3 Conventional Option – The conventional option resulted in 63 lots (note that it is impossible to achieve full allowable density at this site given ordinance constraints on single family development), with an average lot size of four acres. This option involved removal of 30 percent of forest lands at the site, the maximum allowed under current ordinance. Floodplains and wetlands were protected in passive open space. Well, septic, and stormwater management was accounted for on individual lots (Figure 4-7).

Case Study 3 Resource Protection Option – The resource protection option resulted in 67, ½ acre lots concentrated in the agricultural portion of the site. The option avoided impacts to all nontidal wetlands, floodplains, and key wildlife habitats and retained most of the site’s forests. Over 85 percent of the site is preserved as natural land or community open space. A majority of the units front or back to open space and stormwater management was accounted for on open space land. This option allowed for more lots than the conventional option while protecting all of the site’s SRA lands and natural resources and providing an amenity for homebuyers (community open space including trail system). Two design options were prepared for this option, which illustrate a slightly different layout but achieve the same resource protection standards (Figures 4-8 and 4-9).

State Resource Areas
Options for Development of
Property Containing SRAs

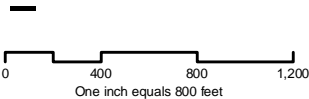
FIGURE 4-7

Case Study 3:
Conventional Option

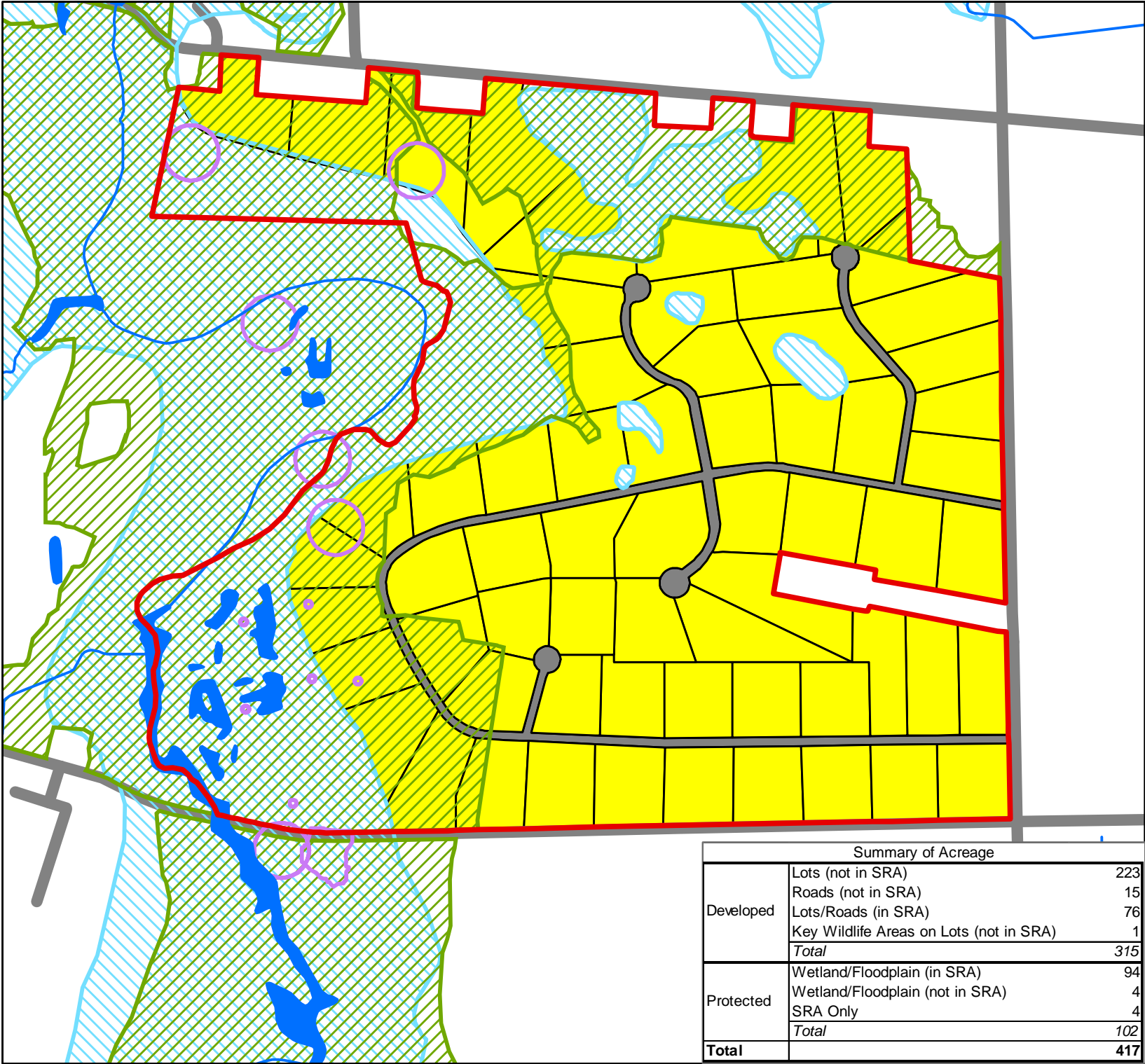
- 63 lots (67 permitted by code but not achievable, given existing environmental regulatory constraints)
- Average lot size: 4 acres
- Well, septic, and stormwater management on lots
- Tree clearing at 30%
- Floodplains and wetlands held in passive open space

Legend

- Proposed Development (417 Ac)
- Lots
- Roads
- State Resource Areas
- Wetlands and 100-year Floodplain
- Key Wildlife Habitats
- Water



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Summary of Acreage		
Developed	Lots (not in SRA)	223
	Roads (not in SRA)	15
	Lots/Roads (in SRA)	76
	Key Wildlife Areas on Lots (not in SRA)	1
	Total	315
Protected	Wetland/Floodplain (in SRA)	94
	Wetland/Floodplain (not in SRA)	4
	SRA Only	4
Total		102
Total		417

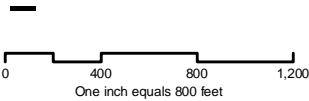
State Resource Areas
Options for Development of
Property Containing SRAs

FIGURE 4-8
Case Study 3: Resource
Protection Option A

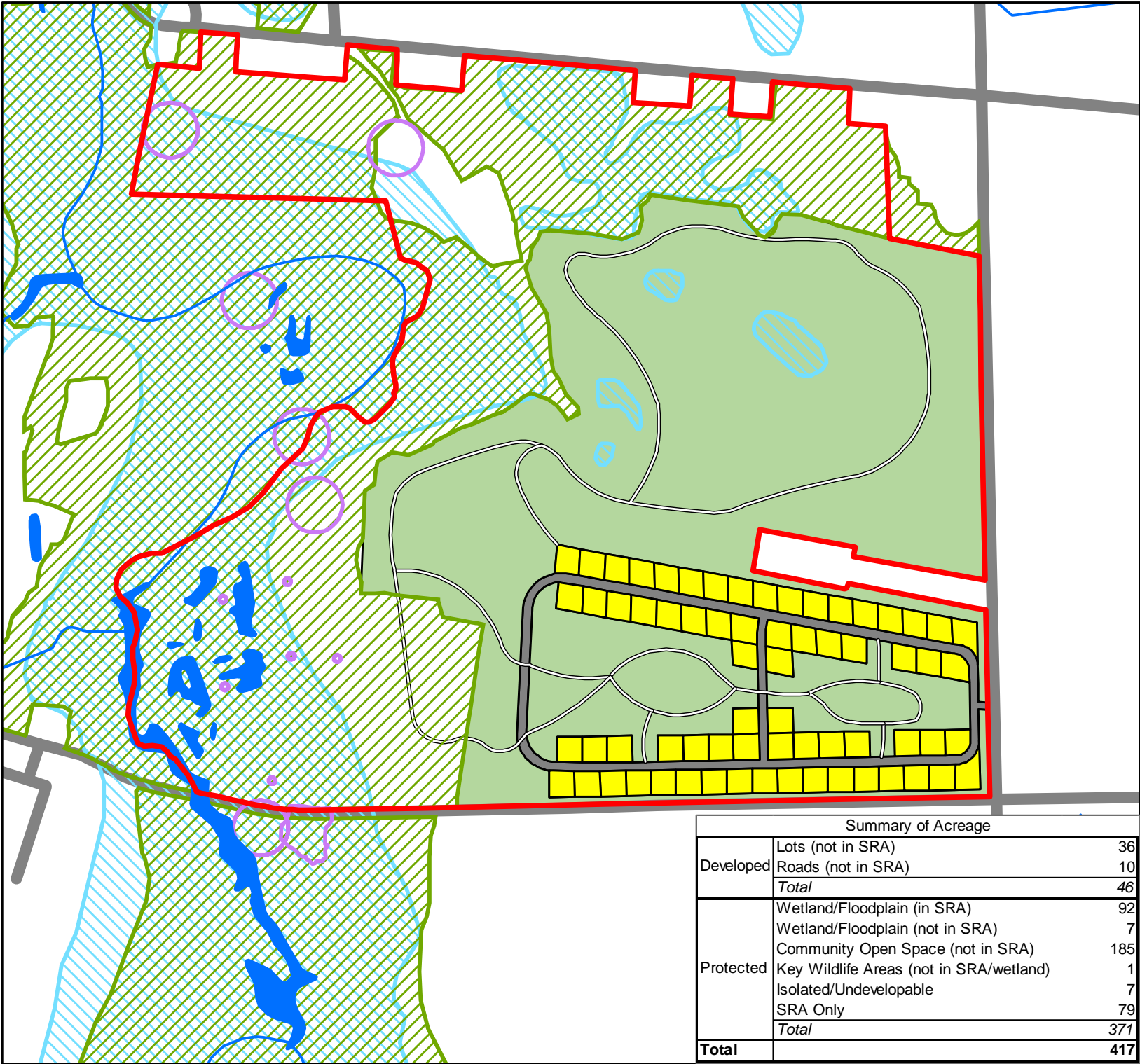
- 67 half-acre lots
- Well and septic on lots
- Stormwater management on community open space land
- Majority of units front and/or back to open space
- 50' buffer around all units
- All SRA, NA, floodplains, wetlands, forest protected

Legend

- Proposed Development (417 Ac)
- Lots
- Community Open Space
- Road
- Trails
- State Resource Areas
- Wetlands and 100-year Floodplain
- Key Wildlife Habitats
- Rivers and Streams



Map produced by the Department of Natural Resources and Environmental Control (DNREC). The information depicted is provided as a graphical representation only. DNREC provides no guarantee, expressed or implied, as to the accuracy of any boundary lines.



Summary of Acreage		
Developed	Lots (not in SRA)	36
	Roads (not in SRA)	10
	Total	46
Protected	Wetland/Floodplain (in SRA)	92
	Wetland/Floodplain (not in SRA)	7
	Community Open Space (not in SRA)	185
	Key Wildlife Areas (not in SRA/wetland)	1
	Isolated/Undevelopable	7
	SRA Only	79
Total	Total	371
		417

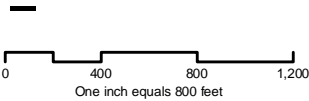
State Resource Areas
Options for Development of
Property Containing SRAs

FIGURE 4-9
Case Study 3: Resource
Protection Option B

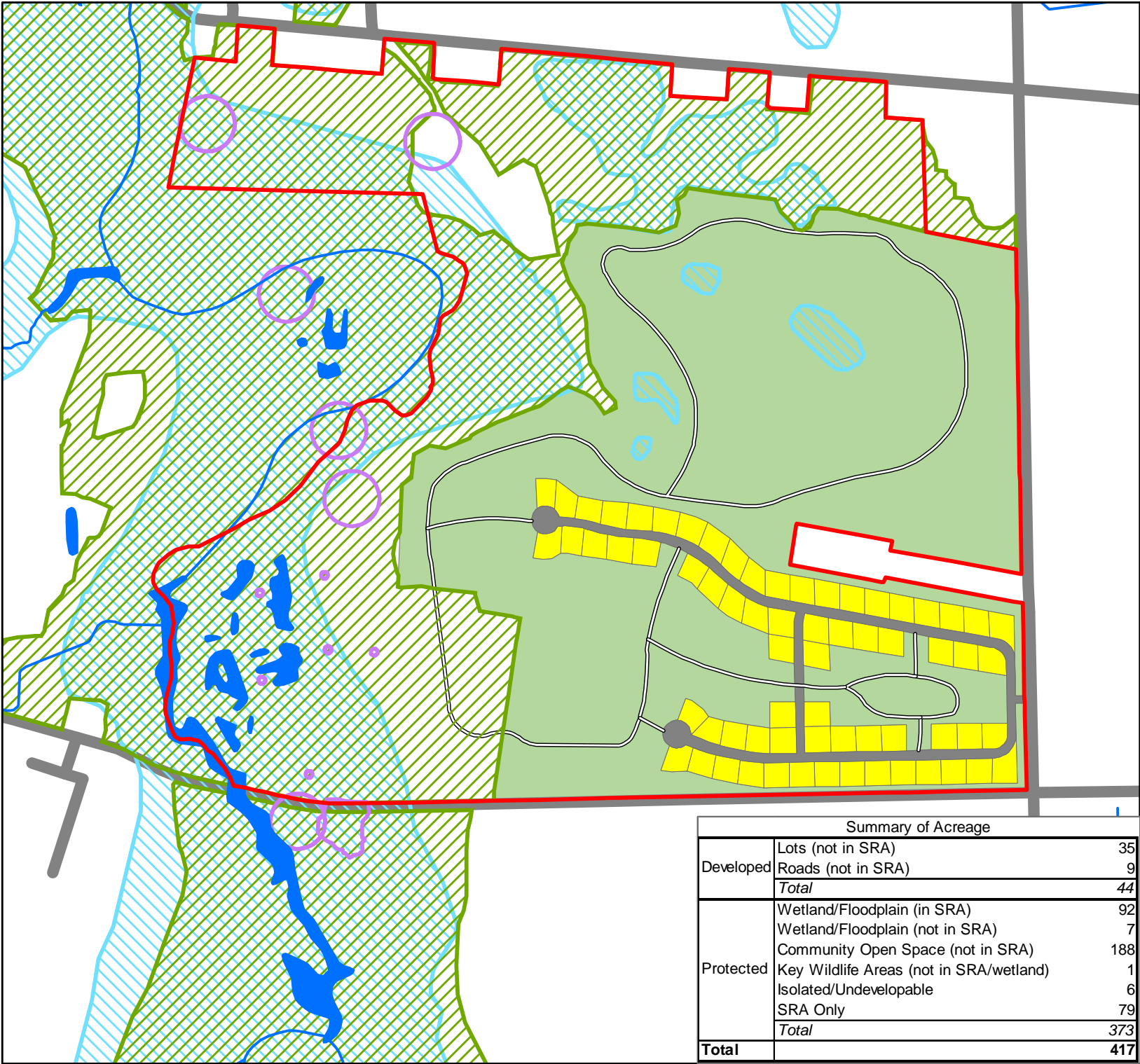
- 67 half-acre lots
- On-site well and septic
- Majority of units front and/or back to open space
- 50' buffer around all units
- All SRA, NA, floodplains, wetlands, forest protected

Legend

- Proposed Development (417 Ac)
- Lots
- Community Open Space
- Road
- Trails
- State Resource Areas
- Wetlands and 100-year Floodplain
- Key Wildlife Habitats
- Rivers and Streams



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Summary of Acreage		
Developed	Lots (not in SRA)	35
	Roads (not in SRA)	9
	Total	44
Protected	Wetland/Floodplain (in SRA)	92
	Wetland/Floodplain (not in SRA)	7
	Community Open Space (not in SRA)	188
	Key Wildlife Areas (not in SRA/wetland)	1
	Isolated/Undevelopable	6
	SRA Only	79
Total	Total	373
		417

Case Study 3 – Lessons Learned

- 1) Kent County Codes currently provide a moderate level of protection for natural resources. For example, subdivision is not permitted in floodplain and tidal/non-tidal wetlands; on the other hand, protections for woodlands fail to protect contiguous blocks of woodland that are fragmented when parcels are lotted out. Furthermore, woodland protection could be more aligned with Department of Agriculture Forest Protection Areas. Although protection of water resources (wellhead areas, recharge areas, etc.) are currently lacking, Kent County's newest draft Comprehensive Plan Update recommends protection strategies for these areas and for State Natural Areas and State Resource Areas.

Kent County currently does use gross acreage (including environmentally sensitive lands) to calculate density; however, development in these areas is generally prohibited (prohibition against subdivision within floodplain or wetlands and buffers from 50 to 100 feet from streams and ditches). Kent County Code provides for as much as 15% passive open space protection inside its growth zone, and up to 35% outside the growth zone for the specific purpose of preserving such areas as mature forest groves, riparian forest buffers and historic, cultural, or archeological landmarks and resources. While this code provision is admirable, it does not necessarily result in resource protection since open space set-asides can be made for other purposes. The new Comprehensive Plan recommends more direct protection of resources which is entirely appropriate. In addition, the County should further consider whether using gross acreage to calculate density is appropriate (awarding density for undevelopable land).

- 2) The county's low density option (principally for use with individual on-site septic systems) bases lots on a sliding scale, presumably to protect groundwater and prevent water pollution. The County currently has provisions for clustering lots for any subdivision which has access to County Sewer and Public Water to allow for better site design and greater environmental protection.

Case Study 3 - Lessons Learned (continued)

- 3) Community septic is permitted as a conditional use at a density of one unit per gross acre; minimum lot size is ½ acre under this option. However, the Kent County Levy Court is currently looking at legislation which would prohibit the use of community septic systems throughout the County. The rationale is to promote subdivision development within the growth zone and discourage residential subdivisions outside of that zone, thus improving the protection of environmentally sensitive areas in the rural portions of the County. Within the growth zone, the Kent County Code provides for reduced lot size when a development has access to Kent County Sewer and Public Water in order to promote protection of any environmentally sensitive areas existing on the subject site. This same legislation has an exception for conditional use cluster development outside the growth zone but limits lots to ½ acre with on-lot septic.

With regards to both the current and proposed ordinance language, the County should give further consideration to permitting community septic when part of a small lot cluster design intended to protect resources and preserve groundwater quality. On-lot septic systems, especially where replacement drain fields may be needed in the future, are generally not seen as appropriate on half acre lots. Furthermore, small lots (under a ½ acre) with community septic could potentially provide greater protection from septic malfunction, preserve groundwater quality and provide greater opportunities for innovative site design that protects more open space and natural resources and provides increased options for stormwater management. Community septic allows for reductions in lot size because it does not require specific lot dimensions. On-site community sewage systems can be used safely and effectively as part of a watershed-based sewage facilities planning effort, provided the intent is to achieve greater resource protection (not increased tract yields). While it is understandable that community septic systems create community management issues, such community-based management is generally easier to monitor and safer than lots with on-lot septic systems.

5.0 APPLYING ECOLOGICAL GUIDELINES TO SRAs

The following sections describe the current protection mechanisms for SRAs and present guidelines for specific actions that counties and municipalities can take to protect the ecological features of SRAs as they prepare to enact future ordinances, standards, design criteria and/or mitigation requirements relative to protection of SRAs.

5.1 Current Protection Mechanisms for SRAs

5.1.1 Plans

State law requires that all Delaware counties and municipalities have up to date comprehensive plans that express the goals and policy commitments for the near and long-range future of their jurisdictions, including goals and policies related to future land use and development (Delaware Planning Act - 29 Del. C. § 9103 and Del. C. § 702). The comprehensive plans provide the policy basis and framework for developing and implementing future zoning and land development ordinances that will define how future land use and development will be managed.

All three county and some municipal plans are currently undergoing a five-year update as required by state law. As previously noted, the Land Protection Act requires that the updated comprehensive plans contain the SRA maps and associated policy commitments regarding protection of SRAs.

The current versions of the county comprehensive plans recognize the importance of open space to overall livability and quality of life and cite the preservation of these characteristics as goals of their comprehensive plans. For example, New Castle County's comprehensive plan includes a chapter on Resource Protection that includes consideration of SRAs (New Castle County, 2006). The Conservation section of Kent County's 2002 comprehensive plan recognizes the importance of conserving open space in order to preserve natural resources and maintain quality of life for current and future Kent County citizens. The Land Use Element of Sussex County's 2003 comprehensive plan includes land use growth management strategies aimed at conserving open space and minimizing the impacts of development on the environment. Because SRAs are a subset of open space lands, goals for open space also apply to SRAs.

5.1.2 Ownership, Easement, or Regulation

More than 79 percent of the State's SRA lands are currently protected from development by public or private conservation ownership/easement or existing regulations that protect specific natural resources (e.g., wetlands, floodplains, steep slopes) (Table 5.1). The roughly 21 percent of lands in the state that are not protected should be the focus of future protective efforts by each of the three counties. Figures 5-1 through 5-3 show the protected and unprotected SRA lands within each county, as defined in Table 5-1.

In some instances, county ordinances provide additional protection to SRAs on a project-specific basis (e.g., open space requirements for subdivisions); however, this area cannot be measured in advance and therefore is not included in the protection analysis summarized in Table 5-1. These “project-specific” ordinances are summarized in Table 5.2.

Table 5.1. Summary of Currently Protected and Unprotected SRA Lands

Level of Current Protection	New Castle County (acres/%)	Kent County (acres/%)	Sussex County (acres/%)	State of Delaware (acres/%)
Total land area	277,383	382,276	626,136	1,285,795
SRA area	67,480/ 24%	101,600/ 27%	116,010/ 18%	285,090/ 22%
SRA protected by ownership/easement ¹	43,102	61,765	67,028	171,895
SRA protected by existing ordinance/ regulation ²	35,135	72,805	24,800	132,740
Total protected SRA ³	56,794/ 84%	89,715/ 88%	77,864/ 67%	224,373/ 79%
SRA not protected as proportion of SRA land area	10,686/ 16%	11,885/ 12%	38,146/ 33%	60,717/ 21%
SRA not protected as proportion of county land area	4%	3%	6%	5%

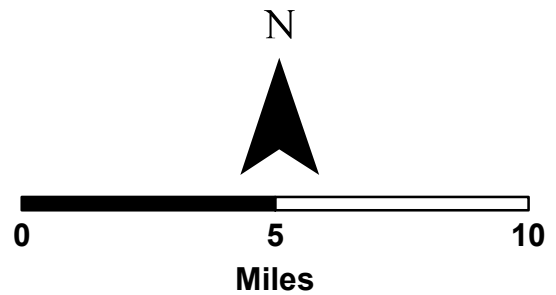
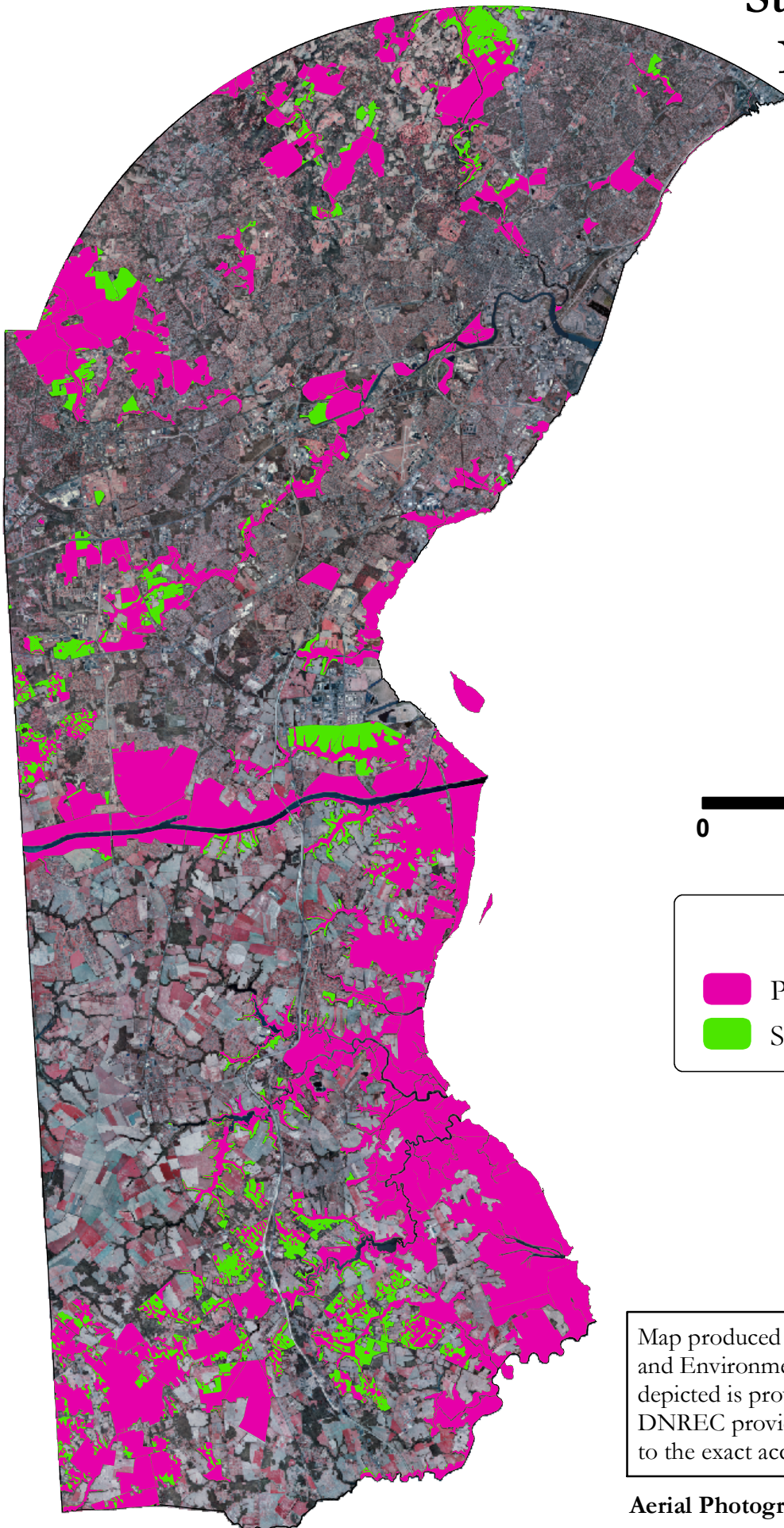
¹ Lands protected by ownership or easement through May 2006. Note that this analysis does not include lands that are protected by towns due to lack of available GIS data.

² The New Castle County ordinance/regulation category includes: 100-year floodplains, non-tidal wetlands, tidal wetlands, and steep slopes >25%. The Kent County ordinance/regulation category includes 100-year floodplains, non-tidal and tidal wetlands, and steep slopes >15%. The Sussex County ordinance/regulation category includes tidal wetlands. See Appendix 1 for additional details.

³ There is overlap between the protected categories (protection by ownership/easement and ordinance/regulation) so the total area of protected SRA is not the sum of the two protection categories.

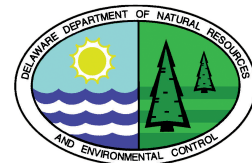
The level of SRA protection offered by existing ordinances and regulations differs by county (Table 5.1 and Appendix 1). In order for lands to be considered protected by existing ordinance/regulation in Table 5-1, the relevant ordinance/regulation had to prohibit activities that could result in diminished ecological function. For example, all three counties have ordinances that prohibit disturbance of tidal wetlands. These ordinances have no exceptions (without variances) or allowable uses that could result in diminished ecological function so tidal wetlands were considered protected in all three counties. Conversely, all three counties also have ordinances that require protection of a 50-foot buffer on tidal wetlands yet wetland buffers were not considered protected in this analysis because the ordinances allow mowing, vegetation removal and other activities that could diminish the ecological function of that resource. For further explanation of what was considered protected in Table 5-1, please refer to Appendix 1.

Figure 5-1 State Resource Areas New Castle County



Legend

-  Protected State Resource Areas
-  State Resource Areas 2006





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Aerial Photography: 2002 Digital Orthophotos

Figure 5-2 State Resource Areas Kent County



Legend

-  Protected State Resource Areas
-  State Resource Areas 2006



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Aerial Photography: 2002 Digital Orthophotos

Figure 5-3 State Resource Areas Sussex County



Legend

- Protected State Resource Areas
- State Resource Areas 2006

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Aerial Photography: 2002 Digital Orthophotos

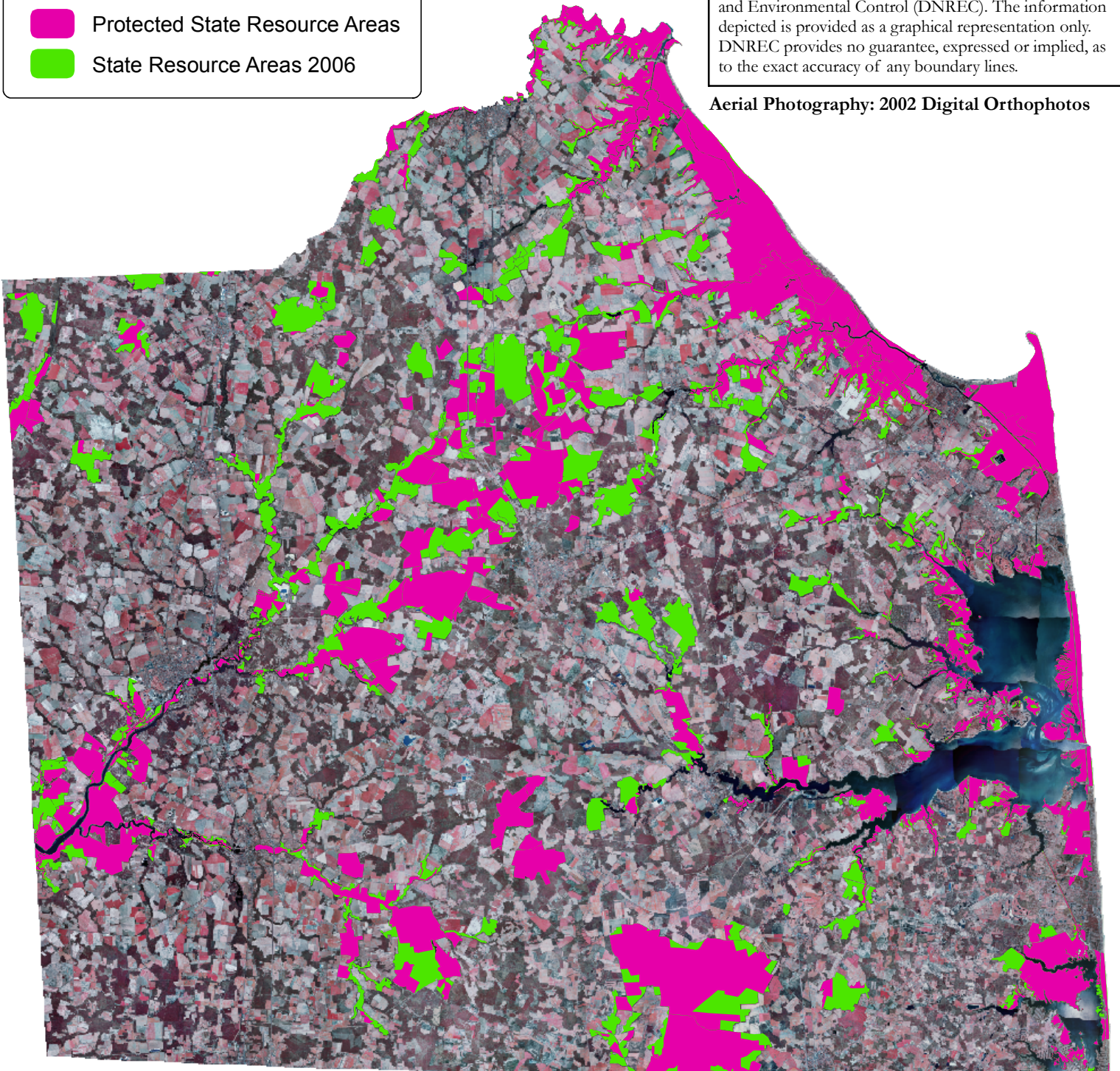


Table 5.2. Existing County Ordinances That Can be Applied to Development Projects to Protect Ecological Features of SRAs (Project-specific Ordinances)

Provision	County	Code Reference
District and Bulk Standards – Open space subdivision options form the basis for conservation design/ecologically sensitive development and have minimum open space requirements – anything over 50 acres has 50% open space requirement.	NC	40.04.110
Resource Protection Standards – Requires developers to produce a Resource Protection Plan that incorporates required protection standards (Table 40.10.010). These standards include 1) open space requirements, 2) site capacity calculations consistent with the appropriate level of protection, and 3) use, protection, and mitigation standards for specific resources. Allows clearing beyond the resource protection levels with a conservation easement that requires reforestation (40.10.350). Within a parcel, highest quality resource areas (such as an SRA) have the highest preservation priority. Plans must reflect sensitivity to such ecological factors as: preservation of vegetation including protecting existing trees from destruction, minimizing of cut-and-fill operations, avoidance of erosion and consequent siltation of streams and drainageways, and other pertinent conservation measures. Development within Critical Natural Areas (CNA) may warrant a requirement for additional preservation of open space at the discretion of DNREC. Agricultural uses are exempted from the provisions of this Section but must have an approved State Forestry Plan using historic forest cover as standard.	NC	UDC 40.03.301 UDC 40.05.400 UDC 40.10.370
Tree Protection and Forest Mitigation - Specimen trees must be preserved wherever practical, mitigation is required for trees that must be removed. Standards emphasize provision of native species and provision of “similar” plant types-accelerates replacement of ecological values and functions.	NC	40.23.300 UDC 40.10.351
Uses identified as “limited” within natural resource area and/or community area open space may be permitted pursuant to DNREC approval. DNREC considers the appropriateness of the proposed use within the context of the proposed plan, its open space management plan and/or the principles of conservation design. Some uses may require an environmental impact assessment report for approval.	NC	UDC 40.10.405-410
Conform post development grading to existing topography and protect designated resource areas on the site to the maximum practical extent.	NC	12.03.001. Design goals. A
Forest Conservation – Applies to minor and major site plans, subdivisions, public utilities not exempt under this section. Does not apply to agriculture, logging, highway construction, maintenance, or surface mining. Requires forest stand delineation and forest conservation plan. Specimen trees must be mapped on the site plan or land development plan. The development design must preserve specimen trees wherever practical or provide mitigation for trees that must be removed.	KC	8

5.2 Incorporating the Ecological Guidelines in Local Government Comprehensive Plans, Programs, and Regulations

The plans, programs, performance standards, and design criteria presented in this section build on the existing protection mechanisms (Section 5.1) to strengthen the protection for SRAs by local governments.

In order to ensure that the important ecological features of SRAs are maintained or improved in the future, county and municipal land planning, programs, and regulations should follow the eight Ecological Guidelines described in Section 3. The State recognizes that flexibility will be exercised by the counties and municipalities to implement the Ecological Guidelines. The recommendations presented in the following sections are made with these considerations in mind.

As stated in the January 19, 2007 letter to the counties, DNREC and the Office of State Planning Coordination will be reviewing each county's updated comprehensive plan and its implementation to assure that they are in alignment with the eight Ecological Guidelines and the actions and measures recommended in this document.

5.2.1 Plans

The Comprehensive Plan provides the overall policy framework for protecting SRAs within the context of broader land use planning. It also provides the basis for implementation programs and regulations

As noted previously, each county and the municipalities that contain SRAs must include in their comprehensive plans SRA maps, policies, and goals as well as a description of strategies and commitments for protecting SRAs. Specifically comprehensive plans should include the following elements.

- Include the SRA map as part of the plan's conservation element.
- Discuss SRAs in relation to the conservation element as a whole.
- Include strategies for land use decision-making that address the eight Ecological Guidelines in relation to protecting the ecological features of SRAs. The discussion of strategies should reflect a review of county regulations, policies, and programs to determine which ones contribute to meeting the eight Ecological Guidelines and the other recommendations presented in this document.
- Outline a development review process for projects proposed within SRAs.
- Describe partnerships needed for implementation (see next section).
- Contain a clear commitment to implement strategies for protection of SRAs.
- Incorporate a timeline on when the implementation strategies will be completed to protect SRAs.

5.2.2 Protection Programs and Strategies

The following are some of the key existing programs and strategies that counties and municipalities are using to protect different kinds of open space. These programs and strategies offer the most effective means for protecting SRAs because they result in permanent protection from development.

Purchase of development rights and fee-simple purchase: When funds are available, counties and municipalities can protect SRAs, or portions thereof, through the purchase of development rights (PDR) or fee-simple purchase. PDR is less expensive than fee-simple purchase and so, in some cases, it can be better to purchase the development rights of several parcels, as opposed to purchasing a single tract. Another option is through a bargain sale, where a property is sold at below market value to a qualified charitable organization or government agency and the seller claims a charitable gift for the uncompensated value.

Counties and municipalities should consider partnering with the state's Open Space Program and local conservation organizations to maximize the conservation value of purchases (i.e., purchase lands to interconnect open space or protect key habitats/species) and maximize purchase power (e.g., joint funding).

Transfer of Development Rights (TDR): TDR is a tool that allows landowners to transfer (i.e., sell) the right to develop a property in one part of the community (sending area) to a property in another part of the community (receiving area). Delaware law currently enables counties and municipalities to establish TDR programs and New Castle and Kent Counties have developed programs. TDRs are sold on the open market where buyers purchase TDRs from landowners and then use them to develop in receiving areas pending government approval. TDR banks also can accept deposits of development rights from the Aglands Foundation, nonprofit land conservancy groups, and others. For more information on TDR programs, refer to the Livable Delaware website <http://www.state.de.us/planning/livedel/tdr.htm>.

Collaborate with conservation organizations to identify and secure strategic private donations: Many conservation organizations work closely with private landowners to protect lands through the donation of land or rights to the land to a qualified conservation organization and/or the county/municipality. The most common type of donation is a conservation easement, in which a landowner (donor) establishes restrictions in perpetuity over the use of their property, or portions thereof. Easements are typically designed to protect unique features of a property by precluding or limiting development. Conservation easements can be an effective way of protecting SRAs, since once an easement has been placed on a site any subsequent proposal for its development will have to abide by the terms of the easement.

Counties and municipalities can work with conservation organizations to combine purchase or TDR options with private donations to maximize the area of protected land. For example, counties and municipalities can collaborate with conservation organizations to secure easements around TDR or purchased lands to maximize the amount of protected open space.

For any protection strategy, counties and municipalities should encourage landowners interested in preserving SRAs or other open land to seek the advice of qualified tax attorneys and accountants to completely review the financial implications of land preservation. Depending on the specific protection option and individual financial situation, landowners should know the effect on their federal and state income, gift and estate taxes. Opportunities for tax credits, charitable contribution allowances and phased income, among other features, may provide for full land value equity to the landowner and accomplish protection objectives at the same time. Local governments also are encouraged to co-sponsor seminars on land protection with conservation organizations.

5.2.3 Ordinances, Performance Standards, and Design Criteria for Minimizing the Effects of Development on the Ecological Features of SRAs

Where outright protection is not a viable option and development of an SRA or immediately adjacent area is proposed, ordinances, ecologically-driven performance standards, design criteria, and mitigation requirements should be applied to limit the effect of development on the ecological features of SRAs.

Within 18 months of comprehensive plan certification, counties are required to develop and implement overlay zoning ordinances, environmental performance standards, design criteria and/or mitigation requirements that will be applied to development projects in order to protect the important ecological features of SRAs. Municipalities are being encouraged to adopt similar protection measures.

Table 5.3 lists specific actions and mechanisms that counties and municipalities can consider for protecting SRAs. These actions and mechanisms are directly related to the Ecological Guidelines. They are categorized as land protection measures and design measures and, if implemented, would build on existing County regulations to increase protection of SRAs. *A combination of land protection measures, design measures, and an effective development review process is needed to ensure adequate protection of SRAs within areas being developed.*

Land protection measures: involve preservation of a minimum amount of open space within a property and/or protection of specific ecological features (e.g. floodplains, wetlands, forests) found within a property.

Design measures: include strategies for designing a project (e.g., compact development, green stormwater design) to minimize impacts on ecological features of SRAs.

Development Review Process: The counties and municipalities should implement development review processes, tailored to their jurisdictions, for all projects occurring within or immediately adjacent to SRAs that would ensure consideration of the eight Ecological Guidelines in development plans. This development review process would facilitate information exchange between the county/municipality and developers/land owners and help refine development plans to maximize natural open space and minimize fragmentation and impacts on rare habitats and species (see Section 6.0 Tools for an example development review process).

The following photographs show examples of developments in Delaware that generally follow the Ecological Guidelines and have minimal effects on SRAs. Note the compact development, minimal impervious surface, preservation of natural habitats, and prevalence of community open space in these developments.



Table 5.3. Summary of Actions and Mechanisms for Developing Ordinances, Performance Standards, and Design Criteria Aimed at Protecting the Ecological Features of SRAs

Action/Mechanism	Ecological Basis/Benefits	Link to Ecological Guideline (EG)	Examples
Land Protection Measures			
Revise or develop stream and non-tidal and tidal wetland buffer ordinances that are protective of ecological functions and values (minimize allowable uses to those that do not degrade ecological value)	<p>Increase amount of natural, undeveloped open space.</p> <p>Maximize wetland and stream quality by providing a natural vegetated buffer between these resources and development.</p>	EG 1, 2, and 5 - Creates larger habitat blocks and promotes continuity of open space. Buffers enhance connectivity between SRAs and limit introduction and encroachment of invasive species.	The state of New Jersey has a wetland buffer law that requires between 50 and 300-foot buffers on non-tidal and tidal wetlands, within which no ground disturbance can occur without a permit and compensatory mitigation.
<p>Require preservation of a minimum proportion of a site as open space (OS) AND</p> <ul style="list-style-type: none"> • Locate OS within SRAs • Aggregate multiple OS when possible • Align OS with offsite OS 	<p>Maximizes protection of open space within SRAs, where the most ecologically valuable open space is located.</p> <p>Aggregation of multiple open spaces creates larger habitat blocks that can support more diverse wildlife and plant populations and facilitate animal movement.</p> <p>Aligning open space with offsite open space lands increases habitat values for area-dependent species and maximizes the cumulative benefits of land preservation on other key resources.</p>	EG 1 and 2 - Creates larger habitat blocks and promotes continuity of open space. Aligning conservation areas with adjacent natural areas enhances connectivity between SRAs and other natural areas.	<p>Cape Cod MA's Regional Policy Plan requires provision of natural open space as a condition of approval for large developments. Between 50% and 200% of the area of the development footprint must be preserved. The plan also requires that connections be made between preserved open spaces on adjacent parcels, and offers incentives for additional protection of natural features beyond the minimums required under the development review standards.</p> <p>Somerville MA's zoning ordinance provides floor area bonuses to developments that provide additional usable open space above the required amounts in selected districts.</p>
Implement protection ratios for key resources (within SRA and buffer)	Key resources (forests, streams, wetlands, etc.) are vital to the ecological integrity of the SRAs and must be protected to preserve the ecological value of the SRA network as a whole.	<p>EG 2 - Buffers enhance connectivity between SRAs.</p> <p>EG 3 - Protecting sensitive landscape features and wildlife is critical to protecting the overall ecology of SRAs.</p> <p>EG 4 - Protecting sensitive communities preserves natural disturbance regimes.</p> <p>EG 5 - Providing a buffer around SRAs discourages</p>	<p>Fulton County GA's Stream Buffer Protection Ordinance requires a minimum 50-75 foot undisturbed buffer on each side of the stream (depending on location), and an additional 25-foot setback adjacent to the undisturbed buffer in which all impervious surfaces are prohibited.</p> <p>Milford township in Bucks County, PA has adopted performance-based zoning</p>

Action/Mechanism	Ecological Basis/Benefits	Link to Ecological Guideline (EG)	Examples
		introduction of invasive species.	regulations that allow developers more design flexibility than they would otherwise have under conventional zoning ordinances in exchange for meeting certain environmentally-based performance standards.
Design Measures			
Encourage compact development	Focusing development in a small area reduces impacts elsewhere in the SRA. Ideally, compact development offsets the impacts of intense development in small areas of relatively low ecological value by preserving larger areas of higher ecological value.	EG 1 and 7 – Compact development minimizes the footprint of built landscapes.	<p>Section 76-3-509 of Montana’s annotated code requires that local regulations promoting compact development also include provisions that set maximum numbers and sizes of parcels, and minimum areas to be preserved through irrevocable conservation easements as a condition of approval. The regulation also allows local jurisdictions to offer incentives, including relaxation of certain environmental review standards and expedited review processes to promote compact development.</p> <p>East Nantmeal Township, PA allows developers the option of using compact development design, provided that all applicable controls, regulations, and standards that would apply to a standard development design are met. These measures include limits on density, layout of streets and lots, placement of structures, and open space set asides.</p>
Allow decrease in lot size or increase in density in rural developments in exchange for maintaining remaining open space	Decreased lot size and/or increased densities in less ecologically valuable areas can focus development away from more sensitive or valuable areas where habitat protection is a priority.	<p>EG 1 - Open spaces reduce edge effects on adjacent SRAs.</p> <p>EG 7 - Decreased lot size and/or or increased densities in less ecologically valuable areas minimizes loss of natural landscapes.</p>	<p>Park City UT allows flexibility in the application of its zoning regulations to incentivize the provision of amenities, including open space.</p> <p>Section 20.90.050 of Vancouver WA’s municipal code allows the gross density that would be allowed on a site’s sensitive resource area(s) to be transferred to the developable portion of the property, or, for parcels with over 50% in sensitive resource area, deducted from</p>

Action/Mechanism	Ecological Basis/Benefits	Link to Ecological Guideline (EG)	Examples
			the minimum required density, allowing up to a 20% reduction in minimum parcel size within the development envelope.
Locate rights-of-way to minimize fragmentation of SRAs and other natural habitats	Minimizing human disturbance and encroachment on natural habitats.	EG 1 – Minimizes habitat fragmentation.	Overlay zones have been adopted in several jurisdictions to ensure that development of transit rights-of-way preserve natural landscapes to the extent possible. Prince George's County, MD's Transit Overlay Zone promotes development near existing or planned public transit stations, reducing the need for additional road and other transportation infrastructure outside existing developed areas. Charles County MD's Highway Corridor Overlay Zone requires that existing greenbelts, natural vegetation, and wildlife habitats be protected within the highway corridor overlay zone. Protective measures include limits on grading and clearing, retention of natural topography, and limits on the number of intersections and access points within transportation corridors.
Establish impervious surface limits	Certain key resources such as wetlands, streams, and floodplains can be impacted by changes in surface hydrology caused by impervious surfaces. Limits on impervious surfaces within SRAs help protect these resources throughout the network.	EG 6 – Reducing the amount of impervious surface reduces the export of nutrients and contaminants from developed areas.	Maryland's Chesapeake Bay Critical Area Law establishes limits of impervious surface within 1,000 of the Chesapeake Bay or its tidal tributaries (the Chesapeake Bay Critical Area). The Chesapeake Bay Critical Area is divided into three overlay zones, with different impervious surface thresholds for each overlay zone. Mercer Island, WA's unified land development code limits the percentage of residential lots that may be covered in impervious surfaces based on the lot slope. For a lot slope of less than 15% the impervious surface limit is 40%; for a lot slope of 15% to 30% the impervious surface limit is 35%; for a lot slope of 30% to 50% the impervious surface limit is 30%; and for

Action/Mechanism	Ecological Basis/Benefits	Link to Ecological Guideline (EG)	Examples
			a lot slope of greater than 50% the impervious surface limit is 20%.
Encourage use of pervious pavements/sidewalks	Pervious surfaces retain some natural infiltration capacity in a developed landscape, reducing the export of contaminants and sediment to adjacent surface water bodies and increasing groundwater recharge.	EG 6 - Pervious surfaces allow for infiltration, minimizing the export of contaminants and sediment from developed areas.	<p>The King County/Seattle Built Green™ program provides financial support for development projects that incorporate environmentally sensitive design features, including pervious surfaces, in Seattle and King County. Eligible projects may receive up to \$15,000.</p> <p>Section 18.12.070 of the City of Bainbridge Island WA's code requires that thirty percent of a property must be retained as pervious surface area. Under this regulation, pervious surface areas include landscaping, unpaved storm water management facilities, underground or overhead utility lines, perimeter fences, and pervious trails. Setback areas and significant tree retention areas can also count towards the required pervious surface area.</p>
Implement green technology stormwater management for developed portions of site	Green technology stormwater management directly mitigates potential physical, chemical, and biological impacts on adjacent surface water and groundwater resources. Reduces peak runoff flow and volume, etc.	<p>EG 6 - Green stormwater management limits export of nutrients from developed areas.</p> <p>EG 7 - Green stormwater management minimizes loss of ecological functions that would occur within conventional stormwater management facilities.</p>	<p>Sandy, OR, charges landowners with more than 2,750 square feet of impervious area per parcel a monthly stormwater management fee, but grants credits toward the fee for property owners that plant trees, vegetated swales, planter boxes, vegetated infiltration basins, green roofs, or other green improvements to mitigate stormwater discharges.</p> <p>Island County, WA's Stormwater Code allows developers to implement low impact development features, including green stormwater management, into their projects in lieu of certain permitting requirements.</p>
Implement voluntary measures to protect key wildlife habitats as per DNREC recommendations	Measures recommended by DNREC to protect key wildlife habitats are focused, specific opportunities to provide specific benefits to certain species.	EG 3 - Protecting KWHs is critical to protecting the overall ecology of SRAs.	King County, WA's Critical Areas Ordinance allows private landowners in the rural (RA) zone to voluntarily develop individualized Rural Stewardship Plans that

Action/Mechanism	Ecological Basis/Benefits	Link to Ecological Guideline (EG)	Examples
			<p>protect wetlands and streams in exchange for exemption from standard critical areas requirements.</p> <p>The City of Bowie, MD has adopted Wildlife Habitat Management Guidelines that are applied to development plan proposals for sites 10 acres and greater.</p>
Implement invasive species control/eradication projects	Controlling and/or eradicating invasive species increases habitat availability for native species.	EG 5 - Invasive species control benefits native species within SRAs.	<p>Brevard County, FL's Ordinance 02-26 amends its Landscaping and Land Clearing ordinances to require the removal of non-native noxious invasive plant species during land development, and control of such species in perpetuity. The amendment is effective countywide across all zoning classifications, and includes government-owned lands. Municipalities are subject to the ordinance, but may opt out of the countywide ordinance by adopting their own ordinance.</p> <p>Title 3.1, Chapter 17.2 of the Commonwealth of Virginia's Code, otherwise known as the Noxious Weed Law, generally prohibits the movement, transport, delivery, sale, or shipment of any noxious weed without a permit. The law allows for inspection of private property and vehicles for the purposes of enforcing the law.</p>
Improve functions of buffers, through increased width or other measures	Increased distance from human activity translates directly to increased protection for several key resources.	<p>EG 1 - Buffers reduce edge effects on adjacent SRAs.</p> <p>EG 2 - Buffers enhance connectivity between SRAs.</p> <p>EG 4 - Buffers protect natural communities, which in turn preserve natural disturbance regimes.</p> <p>EG 5 - Providing a buffer around SRAs discourages introduction of invasive species.</p>	<p>Sec. 21A.50.330(6) and Sec. 21A.50.290(8) of Sammamish WA's municipal code offers options to reduce or average buffers in exchange for other measures that maintain or improve buffer functions, including removal of impervious surfaces, or installation of biofiltration/infiltration mechanisms</p> <p>The Baltimore County, MD Buffer Protection Management Ordinance requires vegetated stream</p>

Action/Mechanism	Ecological Basis/Benefits	Link to Ecological Guideline (EG)	Examples
			buffers of between 25-100 ft depending on use class and stream order, with larger buffers required for highly sensitive or highly valuable streams.
Use only native plants in landscaped areas	Native landscaping plants are less likely to competitively exclude wild plants and more valuable as wildlife habitat than exotic plants.	EG 5 - Eliminating invasive species from developed areas reduces invisibility of adjacent SRAs.	<p>Collier County, FL requires 75% of landscaping trees and 35% of landscaping shrubs to be native species on inland sites. Coastal sites are required to have 100% native landscaping.</p> <p>Section 507, Tab A of the Phoenix AZ Zoning Ordinance requires developers to retain certain vegetative species characteristic of the Sonoran Desert, including certain cacti (6 feet high or greater) and that these plants be utilized on site.</p>

6.0 FACILITATING SRA PROTECTION

A valuable tool in facilitating SRA protection could be a standardized development review process for all development projects that are proposed within an SRA or its 100 foot buffer. There are many ways that counties and municipalities can ensure that SRA's are considered during the development review processes and DNREC recognizes that each county and municipality has unique processes and procedures that affect the way that development review is conducted. The following steps outline an **example** development review process that is designed to address SRAs. *Note that this is just an example of a review process - it is provided to offer guidance to counties and municipalities if they consider developing their own unique development review processes.*

1. Preliminary Consultation/Sketch Plan Meeting - The purpose of the sketch plan step would be for the county or municipality staff to talk to project applicants about incorporating the ecological guidelines into their designs early in the process, prior to site design and development of engineered plans. Staff could advocate use of the ecological guidelines, citing their environmental, cost, and, if applicable, their procedural benefits (e.g., expedited project review or other incentives). At this stage, the counties/municipalities would check to see if the development site contains an SRA or an SRA buffer. If so, county/municipality staff would review the steps in the development review process, provide lists of required plans and reports, and provide a summary of recommended resource protection measures.
2. Site Characterization Report and Preliminary Site Plan - If the development site lies within an SRA or SRA buffer, it would be useful for the applicant to prepare:
 - 1) a Site Characterization Report that describes the environmental features of the site; and
 - 2) a Preliminary Site Plan (sometimes referred to as a Conservation Plan or Natural Resource Protection Plan) that addresses the environmental features of the SRA in the context of the proposed development. The Site Characterization Report could include:
 - map showing the site boundary and the SRA boundary and 100-foot buffer
 - map depicting general land use on the site and all abutting properties
 - map and narrative description of environmental features on the site, including:
 - nontidal and tidal wetlands
 - forest
 - drainageways
 - steep slopes (>25%)
 - steep slopes (15-25%)
 - riparian corridors
 - key wildlife habitats (as defined in the State Wildlife Action Plan)
 - natural heritage program documentation regarding presence of state- or federally-listed wildlife or plant species or their habitats
 - summary of field verification of natural heritage program information

The Preliminary Site Plan would be developed as per applicable ordinances and design standards and include a narrative description of the proposed project, which identifies the required and voluntary measures incorporated in the site plan, any instances of noncompliance with applicable ordinances and design standards, and mitigation measures, if necessary.

3. The Applicant would provide the Site Characterization Report and Preliminary Site Plan to the county/municipality for review. County/municipality staff would review the submittal and provide comments on the Report and Plan to the applicant. The comments would specifically address any concerns regarding SRAs and associated ecological resources and include recommendations for improving the plan, should improvements be warranted. Next, county/municipality staff and applicants would work together to finalize the site plan.
4. One way to ensure the implementation of the final plans would be to require developers to obtain certification from the county/municipality that the development is in compliance with the final site plan.

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Appendix 1. Explanation of the “Protected by Ordinance/Regulation Category” in Table 5-1.

Resource	County	Provision	Considered protected
Wetlands	New Castle	Development is prohibited within non-tidal and tidal wetlands. Development within 50 feet of tidal wetlands (wetland buffer) is restricted to certain allowable uses, which do not guarantee protection of ecological values within the buffer. Therefore, wetland buffers are not considered protected.	Tidal and non-tidal wetlands
	Kent	Development is prohibited within non-tidal and tidal wetlands. Wetland buffers – same as New Castle County above.	Tidal and non-tidal wetlands
	Sussex	Development is prohibited in tidal wetlands. County ordinances do not protect non-tidal wetlands. Wetland buffers – same as New Castle County above.	Tidal wetlands
Floodplains	New Castle	Development is restricted in the floodplain, with certain allowable actions for beneficial use or replacement of nonconforming structures in the Zone A, Zone AE, and non-delineated floodplains. (UDC 40.10.313-316)	100-year floodplain
	Kent	Development and placement of fill is restricted in nontidal and tidal 100-year floodplains, allows limited use of the floodplain and requires flood protection setbacks, new subdivisions not allowed, variance required for altering watercourses. (Kent County Code Section 7.2)	100-year floodplain
	Sussex	County ordinances do not protect floodplains.	None
Steep slopes	New Castle	Steep slopes are protected from “inappropriate development” (excessive grading, land form alteration and extensive vegetation removal). Grading of steep slopes requires approval from the County. (UDC 40.10.340)	Steep slopes >25%
	Kent	Development is prohibited on slopes greater than 15% except under specific circumstances.	Steep slopes >15%
	Sussex	County ordinances do not protect steep slopes.	None